FEBRUARY 27, 1937

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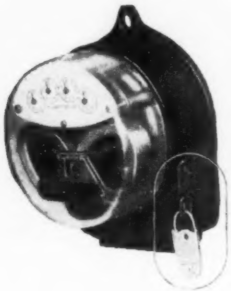
ARCTIC
FRESHNESS
COOL
AIR-CONDITIONED
AIR-CONDITIONED

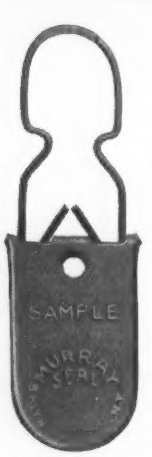
Special Feature

Survey on Commercial Air-Conditioning Marketing Prob [illegible]

Look Alike - *but they're not alike!*

Meter seals may look alike but tests reveal differences . . . prove the Murray Padlock Seal gives positive protection against current diversion





Look For The Name MURRAY

Lighting companies have found from years of experience that meter sealing is one sure way to protect against current diversion.

As a result, most meter superintendents know that meter seals don't act alike, no matter how they look alike . . . that there is no foundation for believing "one seal is as good as another."

Significantly, the Murray Padlock Seal has been chosen by hundreds of lighting companies as their standard sealing system. Its tamper-proof qualities have been proven time and again. Far and wide it is recognized as the one best means of protecting income from pilferers of electric energy.

Details of the unique patented construction of the Murray Padlock Seal will be gladly sent on request. Write today for samples.

METROPOLITAN DEVICE CORP., BROOKLYN, N. Y.

MURRAY PADLOCK SEAL

ELECTRICAL WORLD

FOUNDED IN 1874 ✦ ✦ READ BY ELECTRICAL MEN FOR 63 YEARS

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Coming Features

Co-ordination of Fuse Links

A simple method is described for securing a direct comparison between time-current characteristics of fuse links and overload relays through any range of loading.

Watch for Vibration on Rural Conductors

Increased use of long spans accentuates importance of conductor vibration as a cause of breakage of farm lines. H. H. Brown warns that care must be taken to assure proper sag and tension.

Building Load on Rural Lines

Ten-year record exposes necessity for increased customer equipment — specific appliances are suggested by H. J. Gallagher to raise farm usage.

Modernization and New Uses Help Power Salesmen

L. J. Lamberger cites a multitude of cases where modernization has brought increased profits to the customer and increased load to the power salesman.

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VOLUME 107 . . . NUMBER 9

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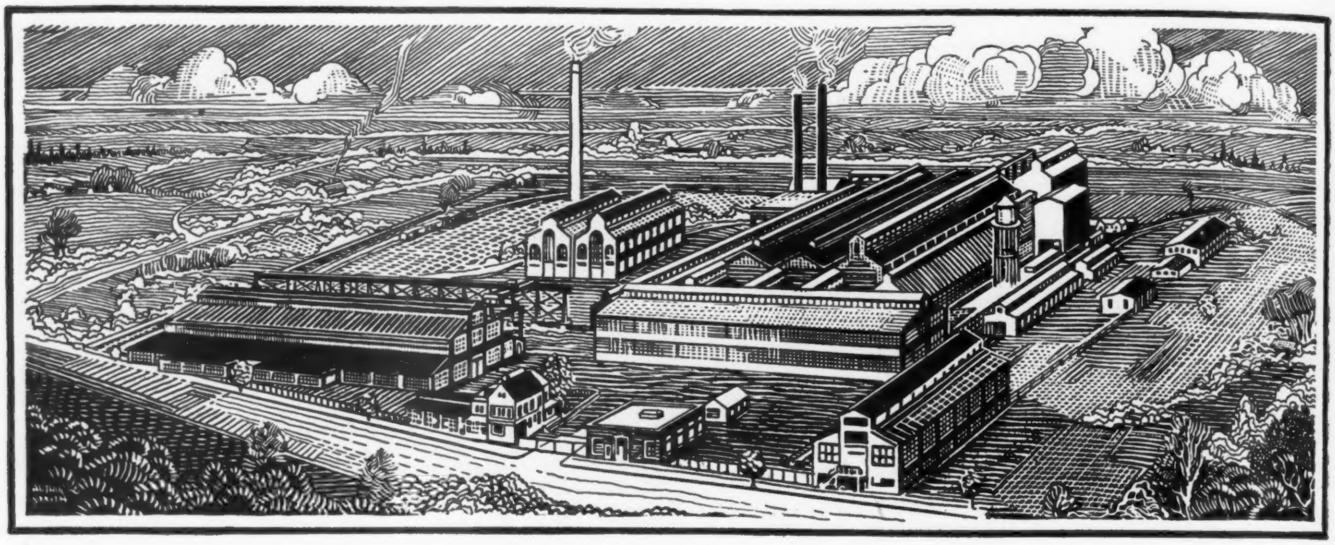
has never stopped!



EVEN during the long economic depression, large research expenditures were made by Okonite-Callender to produce new cables for the already perceptible new trends. The entire field was covered, from distribution to super-tension voltages, and many new features and improvements were developed.

But from the first cable manufactured, this same intensive research has been back of every Okonite-Callender cable. The practical result has been the satisfactory operating performance of the many million feet of Okonite-Callender cables. These are of every type, in every kind of service, in every part of the country. That is the operating record—and that counts most!

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Okonite-Callender cables are made in all types and for every voltage. The chief products are:

Solid, non-shielded, belted paper-insulated cable.
Solid, shielded paper insulated cable.
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Okonite-Callender is licensed to manufacture under patents covering Compack Strand Conductor and other special features such as: Super-dense Paper—Intercalated Paper—Carbon Dioxide Gas Treatment.

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OKONITE QUALITY CANNOT BE WRITTEN INTO A SPECIFICATION

ELECTRICAL WORLD

FEBRUARY 27, 1937

An Opportunity to Improve Wiring

One of the greatest obstacles to the development of the market for electric service and for electric products is the inadequacy of the customer's wiring. This is true not only in the home but in every kind of occupancy. And one of the reasons why this condition continues to exist even in new buildings which are modern in every other way is because while everybody talks about it, seldom does anybody do anything.

For considerably more than a year a joint committee with representatives of the national electrical associations, after setting up standards for adequate wiring, has been strenuously at work compiling a Handbook of Wiring Design. Copies were made available today. It is the first joint industry attempt to provide a working tool so that the standards may be used by any and all who have a part in laying out interior wiring.

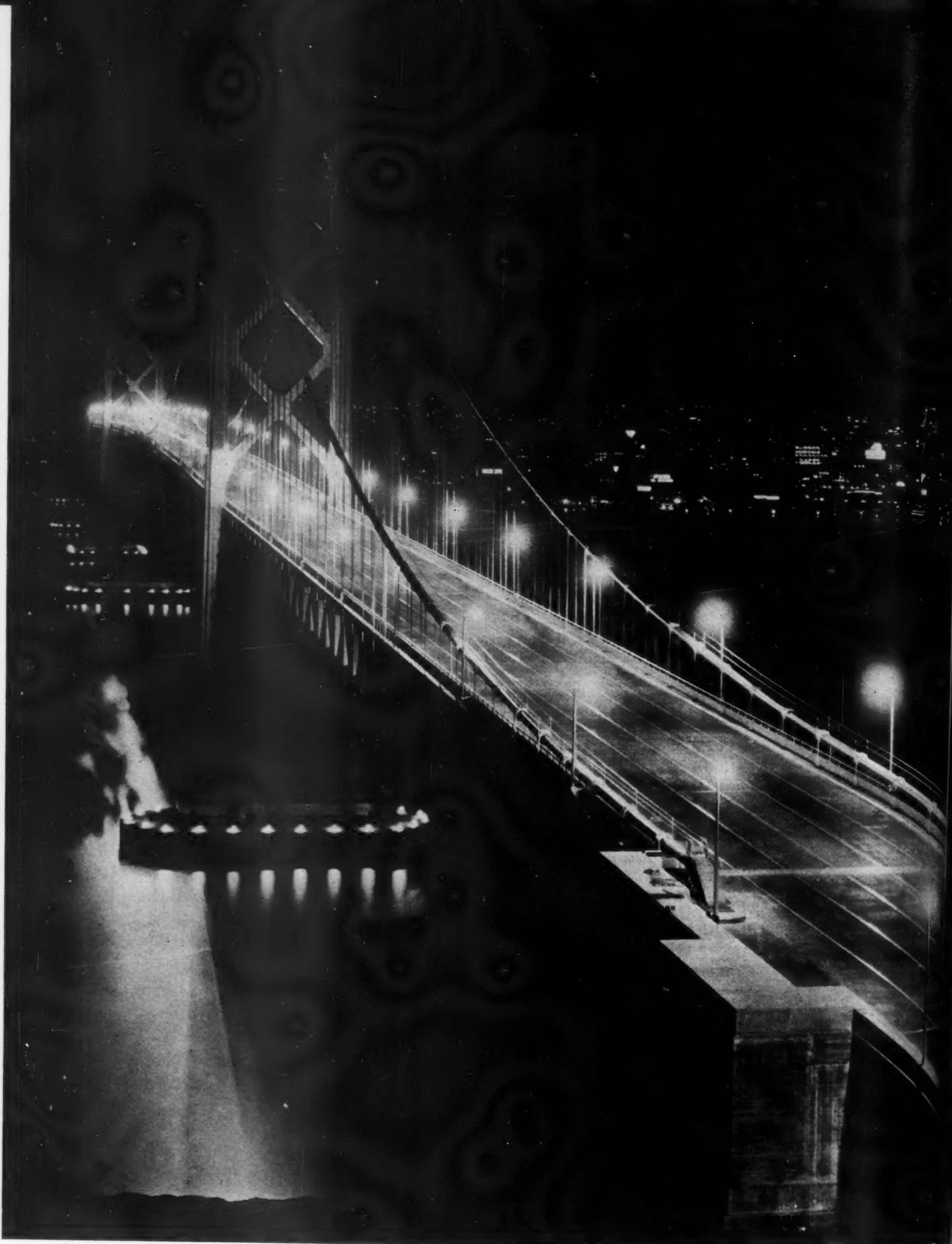
A book, however, no matter how good, cannot change present-day practices. Adequate wiring must be sold. Architects, engineers, contractors and others must be taught the advantages that adequate wiring holds for their customers. When this is done, the handbook—the tool—will be used.

Several thousand copies of the Handbook of Wiring Design will be distributed—then what? Will the work stop there? The committee has made a real contribution and it plans to continue in existence to encourage book usage. But the committee has no funds for campaigning. It can learn what is being done in one locality and pass the word on to others, but as it is at present set up there is little else that it can do which is of a promotional nature.

In other words, the job of truly promoting the use of this long-looked-for tool is now definitely up to the local electrical industry. It can be neglected and the present unsatisfactory wiring conditions will continue to prevail, or it can be made to pay enormous dividends on very modest expenditures.

In the first place a copy should be placed in the hands of every person who might possibly be engaged in any way in the design of wiring installations. And then schools should be set up whereby they could be taught how to use the material in the book. At the same time every person taking out a new building permit should be encouraged to demand that the building be wired in accordance with the industry's standards. Field contact men should be employed to investigate every new job in an effort to improve the wiring in accordance with the suggestions in the handbook.

If these simple and inexpensive suggestions are followed out, the return will many times repay every part of the electrical industry and at the same time the customer will be better served. Adequate wiring opens the way to larger sales of appliances, equipment of all kinds and energy. But until it is sold to the public the opportunities for market expansion will be limited.



California Toll Bridge Author

GOLDEN LIGHT FOR THE GOLDEN GAT

San Francisco lies in the background in this night view of th west span of the San Francisco-Oakland Bay Bridge, taken fro Yerba Buena Island. Light equal to that of 35 full moons i furnished by 10,000-lumen sodium-vapor lamps, equipped wi Alzak reflectors and spaced 150 feet apart.

Expulsion Breaker Field Tests

High Interrupting Capacity, 3-Cycle Arcing Time and Minimum Contact and Oil Deterioration Possible Under Heavy Duty Operating Conditions

By A. C. SCHWAGER . . . V. A. TREAT
Pacific Electric Manufacturing Corporation, San Francisco

Performance under field conditions is the ultimate criterion for judging electrical apparatus. New and improved methods of circuit interruption are but a few years old. Operating characteristics of modern circuit breakers under service conditions provide the best means of evaluating their efficiency and economy and are doubly important in view of the problems confronting the power system engineer incident to the present accelerated load growth. Likewise are tests such as these conducted under operating conditions.

RECENTLY system short circuit tests were made on 69-kv. and 220-kv. systems using both new circuit breakers employing the expulsion principle of circuit interruption and old breakers modernized by the addition of expulsion chambers. This principle of circuit interruption is illustrated in Fig. 1a-d.

The expulsion chamber in its outer appearance resembles the conventional explosion chamber, except that the gases generated by the arc escape through an expulsion outlet in a direction opposite to the direction of the blade travel. The operation differs radically from that of the explosion chamber in that, due to the presence of this expulsion port, no high pressures are generated within the chamber. The gases are accumulated under moderate pressure and, as soon as the oil piston between the arcing tip and the port opening is expelled, form a gas blast through the arc. The dimensions of the oil piston and the port opening are such that for all values of current a sufficient, but not an excessive, amount of gas is generated.

Various contact assemblies applying to breakers for voltages from 15 to 220 kv. are illustrated in Fig. 2. On low voltages, and particularly where high current carrying capacities are essential, the arrangement shown in Fig. 3 has been successfully applied.

The tests described hereafter were performed on high-voltage systems and so involved all phenomena such as exist in actual system operation. On the other hand, the most severe conditions predicted by theory and by factory tests were also given consideration. For instance, since the rate of rise of recovery voltage after interrup-

Expulsion Breakers Tested in 220-Kv. System

Test No.	System Setup	Current: Initial Amps.	Current: Interr. Amps.	Voltage Across O.C.B. Kv.	Cycles: of Arc Time	Cycles: Total time to Clear
1	50,000-kva. condenser capacity. No lines connected	952	415	115	3.2	6.6
2	Condenser plus parts of 110 and 220-kv.systems	3,090	1,525	114.5	2.2	5.5
3		5,260	3,270	113.0	2.6	6.0

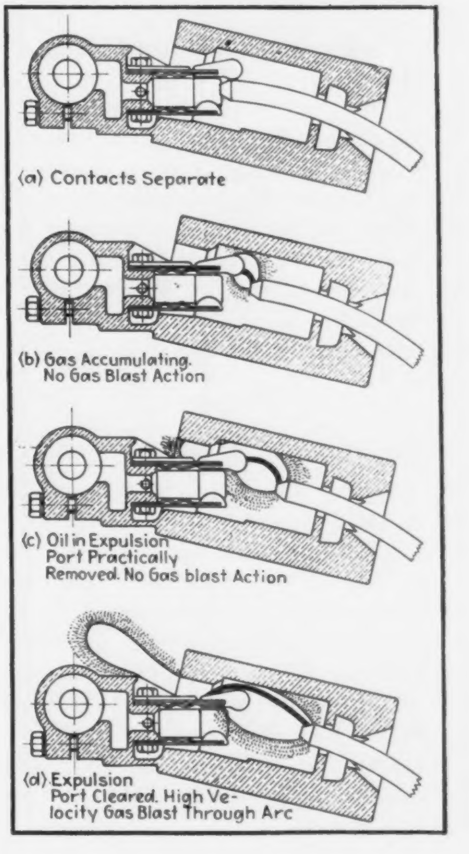
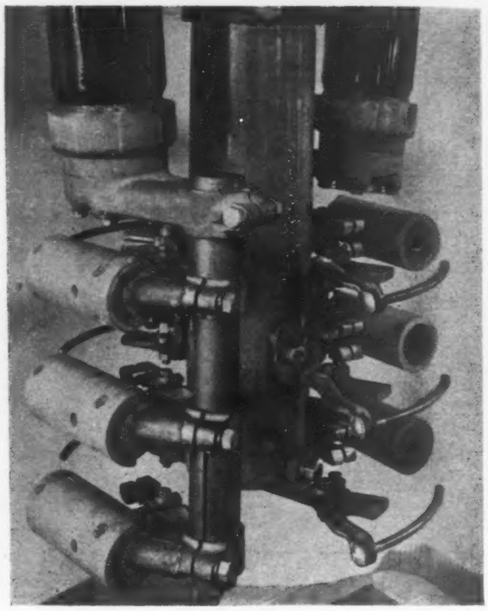

(a) Contacts Separate
(b) Gas Accumulating. No Gas Blast Action
(c) Oil in Expulsion Port Practically Removed. No Gas blast Action
(d) Expulsion Port Cleared. High Velocity Gas Blast Through Arc

Fig. 1—Operation of expulsion chamber contact

(a) Expulsion contact at the time of contact separation. (b) Arc is established and gases are accumulating. These gases expel the oil piston relatively slowly, the instant previous to its final removal being shown in (c). Thereupon, as shown in (d), the gases escape freely and at high velocity through the expulsion port, causing an intense blast and cooling action upon the arc and interrupting it at the next curent zero. The low gas pressure in the expulsion chamber is responsible for the extremely low voltage drop during interruption, resulting in a small arc energy and negligible oil carbonization. The chambers for various voltages are designed of sufficient length for interruption even under the worst conditions of recovery voltage rise to take place within them. Since the total contact separation in the open position is equal to two or more times the length of the break within the chamber a large factor of safety is assured.



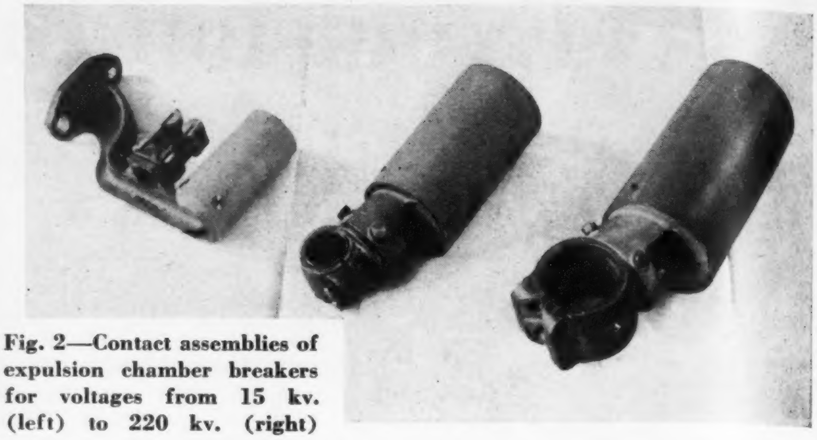


Fig. 2—Contact assemblies of expulsion chamber breakers for voltages from 15 kv. (left) to 220 kv. (right)

Fig. 3—Multi-break contact assembly has expulsion chambers for low-voltage, high-current oil circuit breakers

tion is much greater when power is supplied directly through transformers from rotating machinery, tests with either synchronous condensers or generators alone were performed. Large capacities of rotating machinery were available, 50,000 kva. for the 220-kv. tests and 80,000 kva. for the 69-kv. tests.

220-kv. tests show prompt functioning

The accompanying table gives the result of interrupting capacity tests on a 220-kv. system. All tests were performed single phase to ground and consisted of OCO operations.

An oscillogram of Test No. 3 appears in Fig. 4. In none of the tests was there any external disturbance or loss of oil. Tank pressures were too low to be recorded and were estimated to amount to less than 5 lb. per square inch.

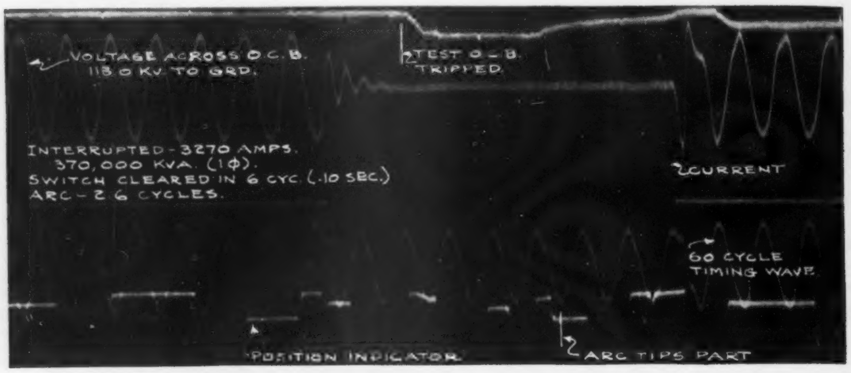
Through the courtesy of Dr. J. S. Carroll of Stanford University a cathode-ray oscillograph record of the recovery voltage was obtained on test No. 3, the measured value of the rate of rise amounting to 800 volts per microsecond. This is a relatively high value for the type of system connection involved.

As indicated above, the arcing time for this test amounted to 2.6 cycles. The arcing time for test No. 1 is slightly higher due to the fact that no lines were connected. The corresponding rate of rise of recovery voltage has been computed and is in excess of 2,000 volts per microsecond. Excellent operating of the breaker is thus demonstrated for the most severe condition of recovery voltage rise and short-circuit current to which it was subjected.

During these tests the performance of a new expulsion chamber breaker and two old breakers which were installed ten years ago and which have been equipped with expulsion chambers was observed. All tests were single-phase-to-ground short circuits. Four tests were performed with a 40,000-kva. generator and no lines connected, the equivalent three-phase kva. interrupted varying from 102,000 to 200,000. Six system short-circuit tests with 75,000 kva. generating capacity at the test location and 90,000 kva. capacity on other points of the system gave equivalent three-phase short circuit capacities varying from 350,000 to 458,000 kva. In all cases the arc was interrupted considerably before the blades had reached the half open position and interruption occurred without oil throw.

Interruption of a system short circuit by one of the ten-year-old modernized breakers is depicted by the oscillogram (Fig 5). It is gratifying to see that the installation of the expulsion contacts brought this old breaker into the class of an eight-cycle breaker, the time to clear the

[*Continued on page 112*]



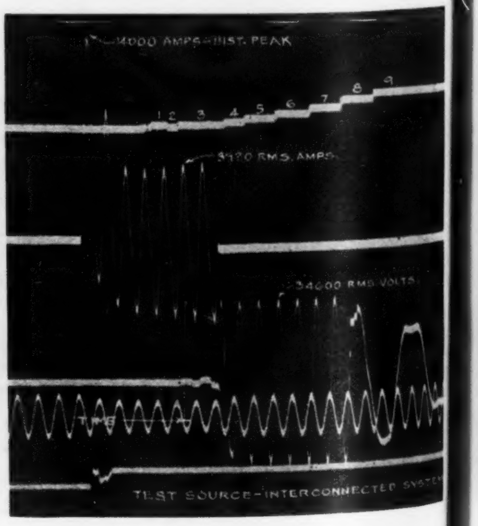


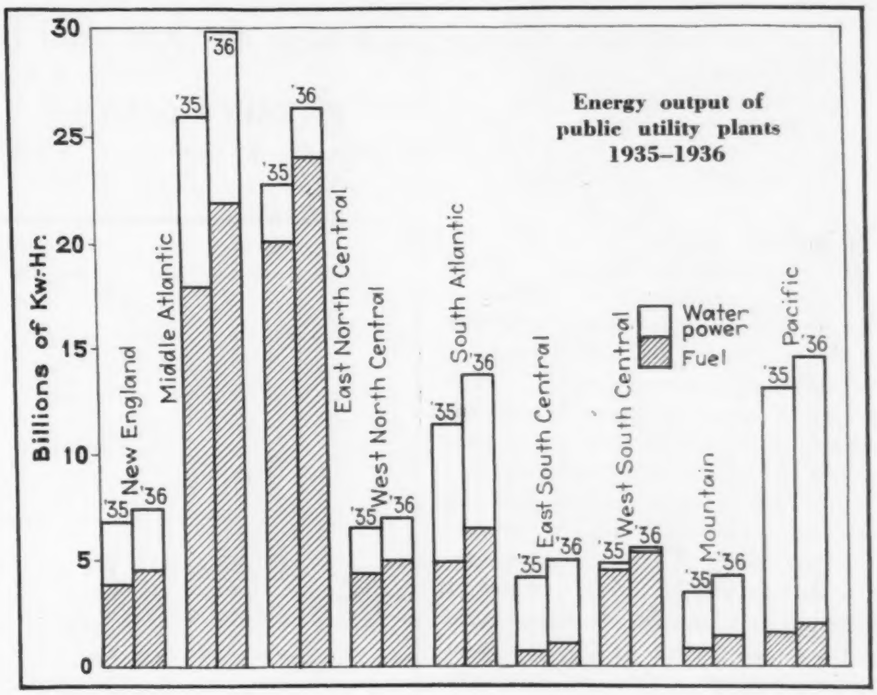
Fig. 4—220 kv. system short-circuit test oscillogram shows arc formed in interrupting 3,270 amp. was extinguished in 2.6 cycles and circuit cleared in 6 cycles. Fig. 5 (Right)—System short-circuits test on ten-year-old breaker equipped with expulsion chambers shows that circuit was cleared in 7 cycles

113,473,000,000 Kw.-Hr.— 1936 Output Up 14 per Cent

Water Power Furnished 40,893,000,000 Kw.-Hr. and Fuels 72,580,000,000 Kw.-Hr., Federal Power Commission Reports

ANNOUNCEMENT by the Federal Power Commission that 113,473,000,000 kw.-hr. was generated for public use in the United States during 1936 affords an opportunity to make comparisons with 1935. While the total increased by about 14,000,000,000 kw.-hr., or 14 per cent, most of the increase was due to a larger output from fuel, whereas there was only a slight increase in production from water power, the percentages being 22 and 2 respectively. The commission points out, however, that hydro-electric output was approximately up to the 16-year average—36 per cent of the total against 36.9 per cent. In 1935 the ratio was unusually high, for it amounted to 41 per cent, whereas 1936 was distinctly a dry year in most parts of the country. These data only reinforce, of course, the oft-repeated statement that water power must be backed by adequate steam to meet deficiencies in stream flow.

In five of the nine geographical regions the increase in production from fuels was actually larger than the increase in the total, for less hydro-electric energy was generated in those regions in 1936 than in 1935. The effect of the drought is evident in the figures for the Mid-West.



The preliminary data indicate that the fuel rate for 1936 will be about 1.45 lb. per kw-hr. as compared with 1.46 lb. per kw.-hr. in 1935.

An analysis of all steam plants using coal exclusively for fuel indicates that the coal rate was 1.49 lb. per kw.-hr. Since these data include coal used in plants held in reserve and operated intermittently this is not representative of good practice.

The national totals in the accompanying table take the place of those published in the ELECTRICAL WORLD of January 2, 1937, at the bottom of page 76, which were partly estimated. These data include the operations of central stations, both publicly and privately owned, electric railway plants, plants operated by steam railroads generating electricity for traction, Bureau of Reclamation plants and that part of the output of manufacturing plants which is sold.

The preliminary report is to be followed by a final one in April.

Annual Production of Electricity for Public Use in the United States—1935 and 1936

	Production of Electricity (millions of kilowatthours)								
	Total			By use of water power			By use of fuel		
	1935	1936	Change (per-cent)	1935	1936	Change (per-cent)	1935	1936	Change (per-cent)
United States	99,398	113,473	+ 14	39,968	40,893	+ 2	59,430	72,580	+ 22
New England	6,914	7,496	+ 8	2,950	2,852	- 3	3,964	4,644	+ 17
Middle Atlantic	25,905	29,281	+ 13	7,836	7,348	- 6	18,069	21,933	+ 21
East North Central	22,833	26,384	+ 16	2,686	2,310	- 14	20,147	24,074	+ 19
West North Central	6,588	7,026	+ 7	2,148	1,497	- 30	4,440	5,529	+ 25
South Atlantic	11,430	13,746	+ 20	6,495	7,137	+ 10	4,935	6,609	+ 34
East South Central	4,206	4,985	+ 19	3,458	3,865	+ 12	748	1,120	+ 50
West South Central	4,879	5,634	+ 15	286	168	- 41	4,593	5,466	+ 19
Mountain	3,518	4,309	+ 22	2,681	3,256	+ 21	837	1,053	+ 26
Pacific	13,126	14,612	+ 11	11,428	12,460	+ 9	1,698	2,152	+ 27

Annual Consumption of Fuels in Generating Electricity for Public Use—1935 and 1936

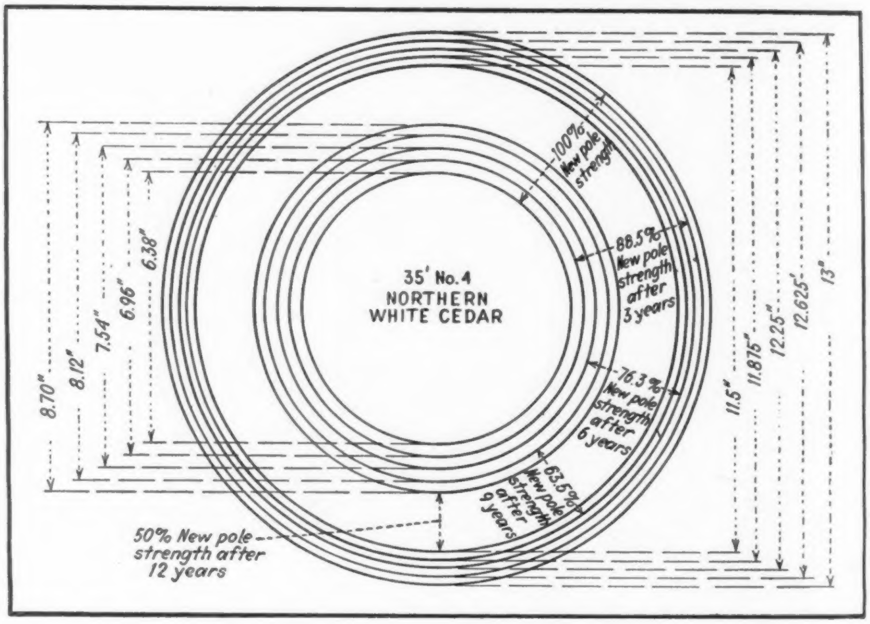
	Coal (thous. net tons)			Oil (thous. Barrels)			Gas (million cu. ft.)		
	1935	1936	Change (per-cent)	1935	1936	Change (per-cent)	1935	1936	Change (per-cent)
United States	34,807	41,973	+ 21	11,393	14,110	+ 24	125,239	155,525	+ 24
New England	2,025	2,380	+ 18	2,623	3,198	+ 22	0	0	0
Middle Atlantic	11,133	13,129	+ 18	3,356	4,868	+ 45	1,602	4,773	+198
East North Central	13,627	16,274	+ 19	145	183	+ 26	9,476	13,359	+ 41
West North Central	3,041	3,627	+ 19	785	927	+ 18	25,002	30,727	+ 23
South Atlantic	3,033	4,076	+ 34	2,331	2,548	+ 9	1,432	2,682	+ 87
East South Central	599	880	+ 47	98	112	+ 14	4,488	5,465	+ 22
West South Central	764	889	+ 16	768	903	+ 18	60,895	72,594	+ 19
Mountain	585	718	+ 23	294	370	+ 26	4,304	5,085	+ 18
Pacific	0	0	0	994	1,001	+ 1	18,041	20,840	+ 16

Years Added to Service Life of Untreated Poles

Personal Opinion Element in Pole Inspection Banished by Use of Calculated Testing Methods —Procedure Here Described Applies to Northern White Cedar, but May be Adapted to Other Woods

By EARLE D. LYON

Assistant Line Installation Engineer Commonwealth Edison Company, Chicago


35' No. 4
NORTHERN
WHITE CEDAR
100% New pole strength
88.5% New pole strength after 3 years
76.3% New pole strength after 6 years
63.5% New pole strength after 9 years
50% New pole strength after 12 years
8.70"
8.12"
7.54"
6.96"
6.38"
11.5"
11.875"
12.25"
12.625'
13"

Progress diagram of pole decay

PRIOR to 1929 the Commonwealth Edison Company tested its untreated poles according to the general method in use. The testing tools consisted mainly of a brace, a bit, a crowbar and a hammer, and it was one inspector's guess against another's as to whether or not a pole was suitable to remain in plant.

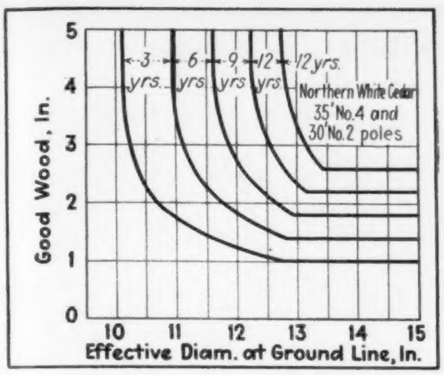
In 1929 it was decided that the method being used did not indicate the true strength of a pole and research was started for a method of simplified testing that would give more accurate indications of the condition of a standing pole. An extensive study was made of the poles which had been condemned by the old method of testing and which had been removed on account of decay. It was found that approximately 50 per cent of these poles had sufficient strength to remain in plant for from three to nine years. Results of the research were the derivation of a new method of pole testing that would eliminate most of the guesswork of the old method. The new procedure is described here as it is applied to Northern white cedar, but it may easily be adapted to other woods.

The difference between science and guess is principally a matter of measurement. Making an experienced guess on pole deterioration may mean discarding poles that have life to serve. That life is saved by making inspections fortified with calipers, augurs and expectancy charts.

Since the institution of the new ideas in 1929 our methods have advanced greatly, so that when a pole is condemned today by a pole-testing crew we feel certain that the pole's remaining strength does not warrant its remaining in plant. Each pole-testing crew consists of an engineer, an inspector from the construction department and an engineer from the other company when joint pole ownership is involved. The crews work under a definite set of simplified rules which are readily interpreted in the field.

The experience of our pole testers over the six-year period from 1929 to 1935 inclusive has been that the average shell or sapwood rot found on an untreated pole when tested was 3/4 in. The remaining loss of strength due to decay was accounted for by the heart rot. The majority of Northern white cedar poles had a certain amount of heart rot when set.

In order to set up mathematical rules for the determination of the remaining strength of an untreated pole in plant it was necessary to make some assumptions based on the experience acquired from pole testing and on



Pole test curves used in field

By referring measured values to this chart the inspector determines if the pole under test shall remain in service and if so how long before the next test.

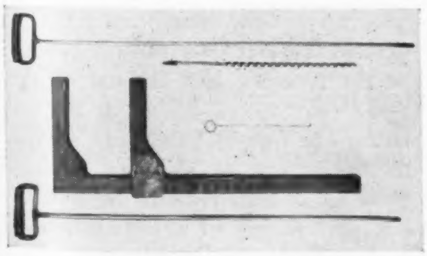
data derived from existing pole records. According to company records the average age of the untreated poles removed from plant because of decay during the years 1926 to 1935 inclusive was as follows:

Year	Number of Decayed Poles Removed	Average Age, Years	Year	Number of Decayed Poles Removed	Average Age, Years
1926	566	15.70	1932	1,787	20.39
1927	827	17.10	1933	1,521	21.61
1928	906	18.60	1934	2,797	22.11
1929	2,271	19.90	1935	2,908	23.40
1930	2,367	19.70			
1931	1,889	19.38		17,839	20.60

There are two reasons for the apparent increase in average age of untreated poles removed during the ten-year period:

1. Practically no new untreated poles have been set since 1921. Consequently, the average age of the remaining poles will be greater when removed, because of the existence in plant of many exceptional poles, either oversize or set in favorable locations or under favorable conditions.
2. A better knowledge of pole strength acquired through pole test experience has enabled us to allow a pole to remain in plant longer than formerly.

Practically all poles set new since 1921 have been treated poles. This makes the age of the most recently set untreated pole now in plant about fifteen years. Because of lack of knowledge of the precise rate of decay twelve years of additional life was decided as the maximum to be given any untreated pole until the next test.



Tools for pole testing

A $\frac{7}{16}$-in. bit, a $\frac{5}{16}$-in. and a $\frac{1}{4}$-in. steel probing rod, an 8-in. gage for measuring the good wood and timber calipers are all that are needed.

Grade C, heavy loading, requires that a pole be replaced when it is decayed to such a point that its strength is only 50 per cent of the pole strength required for new installations. This ruling sets the lower minimum strength of a pole that may be allowed to remain in plant. One hundred per cent new pole strength is assumed for the upper limit in order to provide a standard for estimating twelve years of life.

In the accompanying theoretical diagram of the decay of a pole from 100 to 50 per cent new pole strength, a 35-ft. No. 4 pole is shown of slightly larger ground line diameter than standard in order to allow for possible heart rot. The section modulus required for 100 per cent new pole strength is 202.6 for such a Northern white cedar pole.

Assuming an outside diameter of thirteen inches, the inside diameter of the hollow section is determined from the following formula:

$$Z = \frac{0.098\,(d^4 - d_1^4)}{d}$$

Where: Z = section modulus
d = outside diameter in inches
d_1 = inside diameter in inches

$$\text{Then: } d_1^4 = d^4 - \frac{Z}{0.098}\,d$$

Substituting the values of d and Z

$$d_1^4 = 13^4 - \frac{202.6}{0.098} \times 13$$

$$= 28573 - 26876 = 1697$$

$$d_1 = \sqrt[4]{1697} = 6.38 \text{ in.}$$

For 50 per cent pole strength $Z = 101.3$ and the outside diameter will be $13 - (2 \times 0.75) = 11.5$ in.

Then:

$$d_1^4 = 11.5^4 - \frac{101.3}{0.098} \times 11.5$$

$$d_1^4 = 17490 - 11895 = 5595$$

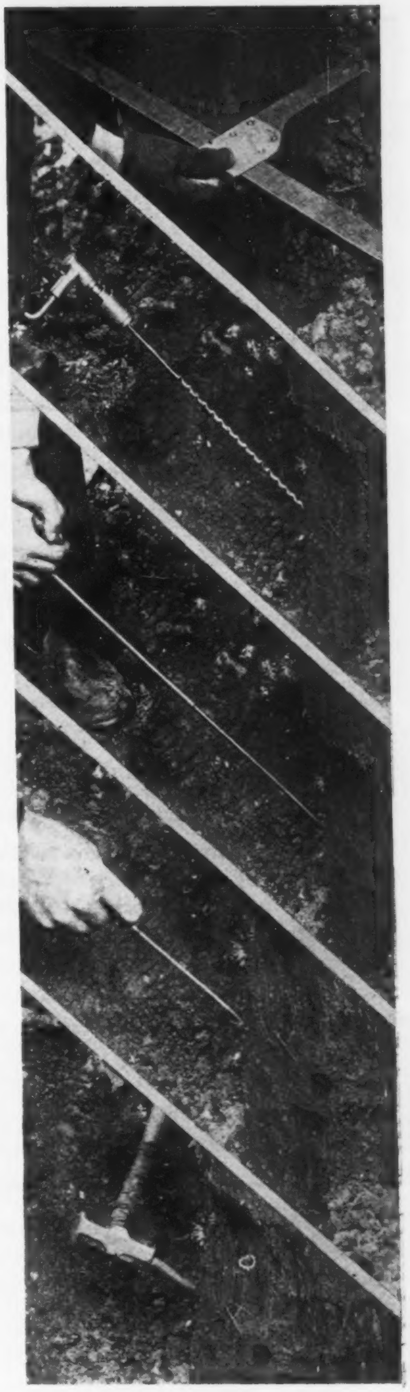
$$d_1 = \sqrt[4]{5595} = 8.7 \text{ in.}$$

$$\frac{8.7 - 6.38}{2} = \frac{2.32}{2} = 1.16 \text{ in. increase heart rot in twelve years.}$$

Assuming a uniform rate of decay, the inside diameter and the outside diameter for each three-year period will be as follows:

	Outside Diameter, In.	Inside Diameter, In.
100 per cent new pole strength	13.000	6.38
After three years.....	12.625	6.96
After six years	12.250	7.54
After nine years......	11.875	8.12
After twelve years....	11.500	8.70

Applying the formula for the sec-



Testing procedure

The larger proving rod is used to determine the depth of shell rot on the pole. The diameter of the pole is measured with the calipers. Twice the depth of the shell rot is subtracted from the diameter, as measured by the calipers, to give the effective diameter of the pole. Holes are bored at a 45 deg. angle to the pole, until the bit contacts heart rot or center of pole. The smaller probing rod is used by thrusting it into the bored hole, to determine if pole is decayed on opposite side and below natural grade. The amount of good wood is measured with the 8-in. gage, which is graduated to read directly in inches at right angles to the pole. By applying these figures of effective diameter and inches of good wood to the pole test curves the pole is either recommended for replacement or is given an estimated life of three, six, nine or twelve years. If the pole is not to be replaced a creosoted plug is driven into the holes that have been bored.

Table I—Characteristics of Northern White Cedar Poles—3,600 Lb. Fiber Stress

Size		Inches		Moments (M) (Foot-Pounds)		Modulus (Z)		Size		Inches		Moments (M) (Foot-Pounds)		Modulus (Z)	
Ft.	No.	Circ.	Diam.	Full Moment	½ Moment	100% New Strength	50% New Strength	Ft.	No.	Circ.	Diam.	Full Moment	½ Moment	100% New Strength	50% New Strength
30	4	36	11.4	44,300	22,150	147.6	73.8	45	4	47	15.0	98,600	49,300	328.6	164.3
30	2	40	12.7	60,800	30,400	202.6	101.3	45	2	50	15.9	118,700	59,350	396.0	198.0
30	1	44	14.0	80,900	40,450	269.6	134.8	45	1	53	16.9	141,400	70,700	471.4	235.7
35	4	40	12.7	60,800	30,400	202.6	101.3	50	4	50	15.9	118,700	59,350	396.0	198.0
35	2	44	14.0	80,900	40,450	269.6	134.8	50	2	53	16.9	141,400	70,700	471.4	235.7
35	1	47	15.0	98,600	49,300	328.6	164.3	50	1	56	17.8	166,800	83,400	556.0	278.0
40	4	44	14.0	80,900	40,450	269.6	134.8	55	4	53	16.9	141,400	70,700	471.4	235.7
40	2	47	15.0	98,600	49,300	328.6	164.3	55	2	56	17.8	166,800	83,400	556.0	278.0
40	1	50	15.9	118,700	59,350	396.0	198.0	55	1	59	18.8	195,050	97,525	650.0	325.0

tion modulus, the following results are obtained for each three-year period:

	Section Modulus	Per Cent New Pole Strength
100 per cent new pole Strength	202.6	100
After three years.....	179.3	88.5
After six years	154.3	76.3
After nine years......	128.5	63.5
After twelve years....	101.3	50.0

The above figures for per cent of new pole strength are the basis for the curves for good wood requirements.

Table II—Grouping of Sizes and Classes of Northern White Cedar Poles According to Section Modulus for 100 per Cent New Pole Strength

Group	Pole Sizes						Z–Full Strength
	Ft.	No.	Ft.	No.	Ft.	No.	
1........	30	4	...	...	...	...	147 6
2........	30	2	35	4	...	...	202 6
3........	30	1	35	2	40	4	269 6
4........	35	1	40	2	45	4	328.6
5........	40	1	45	2	50	4	396.0
6........	45	1	50	2	55	4	471.4

Table III — Thickness of Good Wood Required to Maintain Safely Certain Percentages of New Pole Strength

Ground Line Diam. of Pole in Inches	30 Ft. No. 2, 35 Ft. No. 4 Per Cent of New Pole Strength				
	50.0	63.5	76.3	88.5	100.0
9.125					
9.250					
9.500					
9.875					
10.000					
10.125......	3.82				
10.250......	2.84				
10.375......	2.48				
10.500......	2.25				
10.625......	....				
10.750......	....				
11.000......	1.73	3.64			
11.125......	....	3.00			
11.250......	....	2.67			
11.500......	1.43	2.29			
11.625......	....	....	5.81		
11.750......	....	....	3.45	......	....
12.000......	1.23	1.80	2.73		
12.125......	....	....	....		
12.250......	....	....	....	4.47	
12.375......	....	....	....	3.53	
12.500......	1.08	1.53	2.10	3.12	
12.750......	....	....	....	2.65	5.24
12.875......	....	....	....	....	3.71
13.000......	.95	1.33	1.76	2.33	3.30
13.250......	....	....	....	....	2.80
13 500......	.85	....	....	1.95	2.49

Determination of resisting moments of poles

In order to determine the resisting moment of a pole the moment of inertia in inches to the fourth power must first be determined by the following formula:

$$I = \frac{\pi d^4}{64}$$

Where:

I = moment of inertia in inches to the fourth power

d = diameter of pole in inches

Then,

$$M = \frac{S \quad I}{12 \; C}$$

Where:

M = resisting moment in foot pounds

S = fiber stress in pounds per sq. in.

(S = 3600 for Northern white cedar)

I = moment of inertia in inches to the fourth power

C = distance to extreme fiber in inches.

For example:

35-ft. No. 4 Northern white cedar pole

$S = 3600$

$d = 12.73$ (standard ground line diameter)

$C = 6.37$ (half the diameter for solid pole)

$$I = \frac{\pi \times 12.73^4}{64} = 0.049087 \times 12.73^4 = 1290$$

$$M = \frac{S \quad I}{12 \, C} = \frac{3600 \times 1290}{12 \times 6.37} = 60{,}800$$

Determination of section modulus of poles

The section modulus is determined from the following formula:

$$Z = \frac{12 \, M}{S}$$

Where:

Z = section modulus

M = resisting moment in foot pounds

S = fiber stress in pounds per sq. in.

For example:

35-ft. No. 4 Northern white cedar pole

$M = 60{,}800$ (as determined above)

$S = 3600$

$$Z = \frac{12 \times 60{,}800}{3600} = 202.6$$

Table I is the result of applying the above formulas to Northern white cedar poles of standard diameter as established by the American Standards Association. The poles are arranged into groups as shown in Table II.

The amount of good wood required for any percentage of pole strength and any size of ground line diameter may be determined from the formula:

$$d_1^4 = d^4 - \frac{Z}{0.098} \, d$$

Where:

d_1 = diameter of inner circle

d = outside diameter of pole at ground line

Z = section modulus of per cent of new pole strength required (based on the section moduli shown in Tables I and II)

For example:

The section modulus of a 35-ft. No. 4 pole for 63.5 per cent pole strength is 63.5 per cent of 202.6 or 128.8.

Assuming an outside diameter of thirteen inches:

$$d_1^4 = 13^4 - \frac{128\,8}{0.098} \, d = 11460$$

$$d_1 = \sqrt[4]{11460} = 10.35 \text{ in.}$$

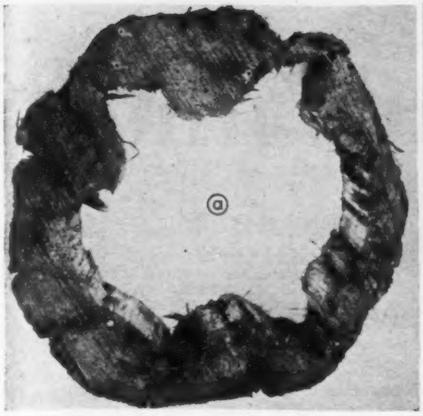
$$\textbf{Good wood required} = \frac{13.00 \text{ in.} - 10.35 \text{ in.}}{2} = 1.33 \text{ in.}$$

The good wood requirements for Northern white cedar poles for various sizes of ground line diameter and for 50, 63.5, 76.3, 88.5 and 100 per cent of new pole strength have been calculated as shown in Table III.

Pole test curves

From the figures in Table III pole test curves have been plotted with the ground line diameter of pole in inches as the abscissa and amount of good wood required in inches as the ordinate. The figures have been modified to the extent of showing minimum good wood requirements for the various percentages of new pole strength as follows:

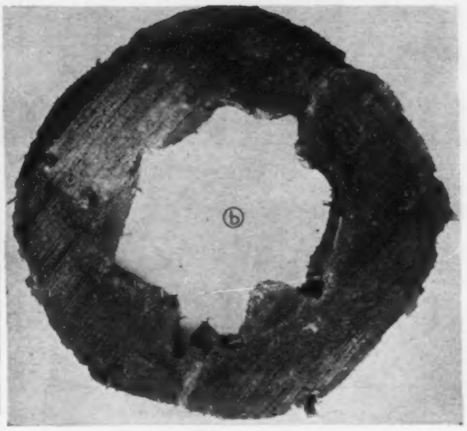
New Pole Strength	Northern White Cedar, In.
50.0 per cent................	1.0
63.5 per cent................	1.4
76.3 per cent................	1.8
88.5 per cent................	2.2
100.0 per cent................	2.6



Kind of pole now being removed

(a) This is a 6-in. section cut from a 40-ft. No. 2 Northern white cedar pole replaced after 22 years in plant. Top of section 2 in. and bottom 8 in. below ground line. The breaking moment for this pole was 53,250 lb., 43.8 per cent of standard for the size and grade.

(b) This is a section cut 2 in. above and



Kind of pole removed—too often

2 in. below ground line from a 35-ft. No. 4 Northern white cedar pole that was replaced after seventeen years in service and before the new testing procedure was adopted. The breaking moment was 57,000 lb., 93.7 per cent of standard for the size and grade. This exhibit shows how good poles were often replaced unnecessarily.

The interpretation of the pole test curves is as follows:

(a) Poles showing less than 50 per cent new pole strength shall be replaced.

(b) Poles showing between 50 and 63.5 per cent new pole strength shall be given three years additional life.

(c) Poles showing between 63.5 and 76.3 per cent of new pole strength shall be given six years additional life.

(d) Poles showing between 76.3 and 88.5 per cent of new pole strength shall be given nine years additional life.

(e) Poles showing more than 88.5 per cent new pole strength shall be given twelve years additional life.

Three men in pole test crew

A set of pole test curves for all sizes of poles is furnished each pole-testing crew. In addition to the curves, each crew is furnished with the tools illustrated and whose uses are shown in the picture series. The work of testing the poles by the use of the tools and the methods disclosed in the pictures is divided between the three men in the pole test crew. In unpaved alleys approximately 18 in. of soil is removed from the base of the pole; in paved alleys the testing is done just above the pavement.

Since 1929 the company's entire untreated pole plant has been tested under this system and all poles have either been replaced or given an estimated life of three, six, nine or twelve years. A systematic test is made each year of all untreated poles which previous tests have shown to be retested in the particular year.

Periodically a reasonable number of ground line cross-sections are sawed out of poles which have been recommended replaced by this test and are analyzed. A sample of one of these cross-sections and the results of the analysis is shown. Practically all of the cross-sections analyzed by this method show the remaining amount of good wood to be less than 50 per cent of the original strength of the pole. Only a few of the cross-sections analyzed showed the remaining amount of good wood to be slightly over 50 per cent of the original strength.

From these analyses we believe that the company is obtaining practically the entire life of its untreated poles by this method of pole testing.

In comparison with the above method, a similar analysis was made of cross-sections of pole recommended replaced by the method used previous to 1929. A sample of one of these cross-sections is also shown. An analysis of this cross-section using our present methods shows that when this pole was recommended replaced by the old method it still had 93.7 per cent of the original pole strength. This proves that this pole was recommended replaced by the old method many years ago before it would have been replaced by our present method of pole testing.

In conclusion, we believe that the use of our present method of testing untreated poles based on mathematical rules for the determination of pole strength rather than the old method of one inspector's guess against another's, used prior to 1929, is resulting in savings from obtaining the full useful life of the untreated pole now in service.

INDIVIDUAL INITIATIVE, RESEARCH AND INDUSTRY

It is the fashion in certain quarters to say that the system of capitalism —or, as I prefer to term it, individualism—has failed. The system is one of progressive evolution, and as one writer put it recently:

"The historic record is a continuous story of social advancement; new arts, new services, new products, new employments, new enjoyments and always new possibilities giving zest to life. Within the range of memory electricity, the telephone, the automobile, the moving picture, the radio, the airplane have been developed into common use, and every industry rendering services to the public continuously made over by improvements. Steel and its alloys, the oil industry, modern printing, modern paper-making, the modern newspaper, modern engineering, modern plumbing, modern heating and refrigeration, and so on without end, are of the same period. Moreover, life has been lengthened, health protected, hygiene, medicine and surgery advanced, education extended, culture broadened, and the common standard of comfort and usefulness has been raised. And all of this has resulted from freedom of individual initiative, with specialization on research, learning and industry—vital principles of social progress."

In the past it has adapted itself to changes in economic conditions and social concepts, and there is no reason to think that such adaptations will not continue to be made. In fact, they must be made if the system is to survive.

M. W. WILSON,
President and managing director, the Royal Bank of Canada.

Synchronism Without

Points to Observe in Applying Versatile Synchro-Tie Drives to Tension and Constant-Speed Tasks

For machines or parts of machines which must run often in synchronism, the power between the machines or sections of machines may be transmitted by wires instead of complicated mechanical equipment and applied where desired by close-coupled motors or gear-motors. The following are typical applications of synchro-ties analyzed in this article:

Textile bleachery machines in tandem.
Linoleum calender and conveyor.
Paper calender and winder.
Bottle-making machines and conveyor.
Remote operation of valves.
Remote operation of belt shifters.
Kiln and kiln feeder mechanisms.
Marine ways using several units in parallel.
Steel mill screwdown control.
Bascule and lift bridge control.

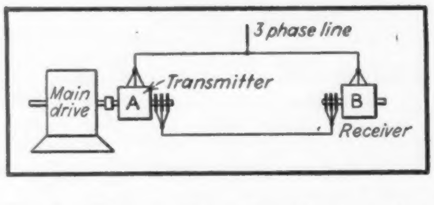


Fig. 1—Theory of synchro-tie operation

A and B represent two wound-rotor induction motors of the same rating and characteristics. Machine A, which is connected to the driving source, is called the transmitter, while B is the receiver and delivers the power received to some other machine. When the rotors are connected in proper phase relation and the primaries excited the secondary voltages will be equal and opposite, so that no current will flow through the rotors and there will be no torque developed or tendency to rotate. As machine A is turned, even a few degrees, the rotor voltages are no longer equal and the flow of current develops a torque, tending to bring the two rotors into the same angular position. If A is rotated continuously B will rotate at exactly the same speed, but there will be a small angular or phase difference between the machines, which is necessary to circulate the load current. By using a different number of poles on the transmitter and receiver it is possible to obtain synchronous operation, but at different speeds, and thus eliminate mechanical gear ratios or simplify the mechanical transmission. For instance, a six-pole transmitter would cause a two-pole receiver to operate three times as fast as the transmitter is driven. Such drives must be specifically designed for each application.

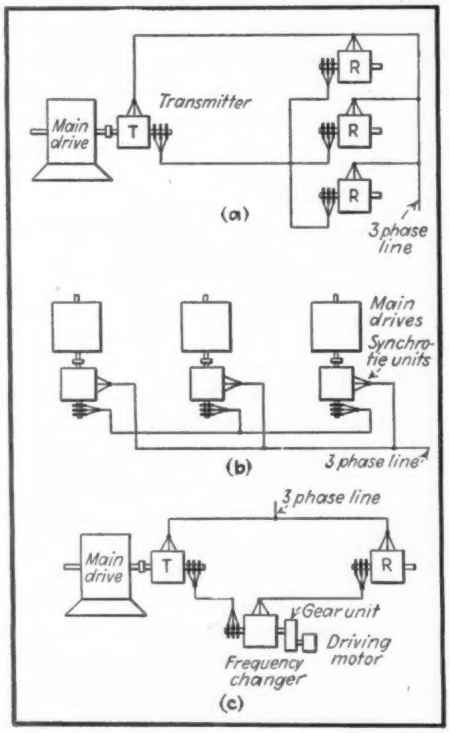


Fig. 2—Modifications of synchro-tie systems

Although the simple drive as outlined in Fig. 1, consisting of one transmitter and one receiver, is most commonly used there are various other combinations possible which are advantageous for certain applications.

(a) Use of one transmitter to supply power to two or more receivers as might be required for synchronizing several auxiliary drives on one machine.

(b) In drives of large capacities it is frequently desirable to supply power directly to the various sections and to hold all sections in synchronism by means of synchro-tie units. The size of the tie units is determined by the unbalanced load between the main drive and any tie unit may operate either as a transmitter or receiver depending upon load conditions.

(c) In a simple system as Fig. 1 it is sometimes desired to operate the receiver slightly slower or faster than the transmitter and to control this in order to maintain a constant tension in the material handled, to hold a constant load or some other function. This may be accomplished as shown in Fig. 4 by interposing another wound-rotor motor in the rotor circuit and rotating it at a slow speed. At zero speed this unit or frequency changer has no effect on the speed of the receiver, but does introduce impedance in the circuit, which materially reduces the torque available, or to deliver the same torque requires units of larger capacity. If the frequency changer is rotated continuously the speed of the receiver will be increased or decreased depending on the direction in which the frequency changer is driven. Various arrangements of the driving equipment and control are possible to meet manufacturing conditions and each problem requires special consideration.

IT IS well known that two or more wound-rotor induction motors with the primaries excited from a common source of alternating current and with the secondaries connected together will,within certain limits, maintain a synchronous relation. Such a combination of wound-rotor motors is known as a synchro-tie system.

When the shaft of one machine so connected is rotated by some external mechanical means the other machine will rotate at exactly the same speed. Although, running at the same speed there is a small angular displacement between the two machines, depending on the torque transmitted, but this displacement remains constant for a given load. A shaft transmitting power has quite similar characteristics since there is a torsional deflection between the ends of the shaft depending on the diameter and the value of torque transmitted, but there is no difference in the speed between the two ends of the shaft.

Although units of small size such as used for metering and indicating angular displacements are operated from a single-phase power supply, the transmission of higher torques and the use of continuously running drives usually involves polyphase machines. Wound-rotor motors connected in synchro-tie relations no longer have induction motor characteristics and the new characteristics must be fully understood in order properly to apply and use such equipment. If adequate consideration is given to these factors there is no practical limit as to the size and variety of applications that may be made.

The following characteristics apply to synchro-tie units involving motors above the fractional-horsepower rating:

1. Units are rated on a torque rather than on a horsepower basis, since they may operate at any speed from zero up.

Mechanical Connection

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Industrial Division,
Westinghouse Electric & Manufacturing Co.,
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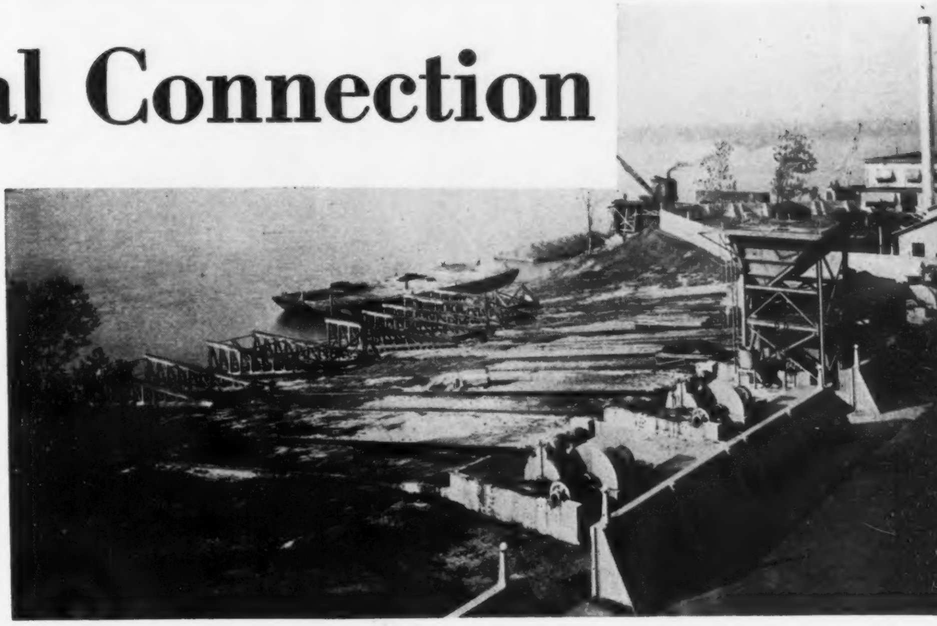


An electrical lineshaft. Six cradles for a marine way individually motored and synchronized by synchro-ties. Each unit consists of a 30-hp. gear-motor with a 20-hp. synchro-tie

2. The torque that a machine will carry continuously without injurious heating is reduced at low speed due to decreased ventilation, but this limitation may be removed by the use of forced ventilation.

3. Although varying with individual designs and ratings most synchro-tie units in the smaller sizes will transmit continuously the normal rated motor torque at speeds of 50 per cent of synchronous or above without reaching unsafe temperatures.

4. The heating and rating will depend on the direction of rotation; that is, whether with or against the rotating field.

5. Mechanical degrees displacement between units equals electrical degrees divided by number of pairs of poles per unit.

6. Two-pole machines will synchronize in one position only and consequently are required for position indicators and similar service. Four-pole units synchronize in two positions, six-pole in three, etc.

Torque and speed characteristics of synchro-ties

Synchro-tie units may be operated either with or against the direction of the rotating field. (With the field means in the same direction that the unit would run individually as a motor.)

When operated with the field:

1. The receiver torque is greater than that of the transmitter.
2. The maximum receiver torque is greater than the rated maximum torque of the motor.
3. The receiver and the transmitter torques decrease rapidly toward synchronous speed.
4. Operation at speeds above 50 or 60 per cent of synchronous speed is questionable except for very steady loads.

When operated against the field:

1. The transmitter torque is a maximum.
2. The receiver torque increases with the speed and approaches the value of the transmitter torque.
3. The maximum operating speed is determined primarily by mechanical limitations.
4. The frequency and losses in the rotor increase with the speed and have an effect on the rating.

Regardless of the direction of rotation, the maximum torque values of the receiver and transmitter vary with the speed and also for any speed the maximum values occur at different displacement angles.

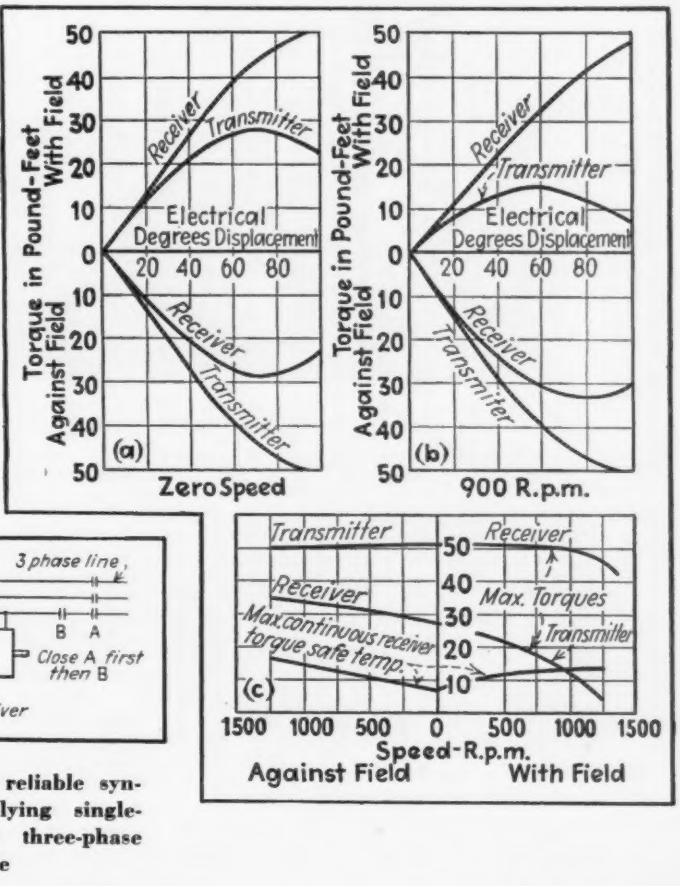
Points to consider when making an application:

1. Maximum starting and running torques.
2. Continuous running torque or load cycle.
3. Operating speed range.
4. Rate of acceleration and deceleration.
5. Character of load: (a) High or low inertia. (b) High or low friction. (c) Pulsating or steady.
6. Other operating requirements such as the necessity for individual operation, type of control desired, mechanical connection, atmospheric conditions, etc.
7. Type, size and characteristics of machine and control which drive the transmitter.

Fundamentally, an application of synchro-tie units involves the same procedure as the making of an ordinary motor application; that is, an analysis of the speed, torque, time characteristics of the driven machine and the choice of a properly rated motor to perform these. The principal difference is that while informa-

Fig. 3. Characteristic speed torque curves with two 5-hp., four-pole wound rotor motors

Safe continuous torque (c) when operating with the field at 900 r.p.m. is approximately 14 ft.-lb. while the maximum receiver torque at this speed is about 50 lb., or over 3.5 times the continuous capacity. When developing 14 ft.-lb. the angular displacement (b) between the two machines is approximately 25 electrical degrees (12½ mechanical degrees for four-pole machines), and for lighter loads would be proportionately smaller.



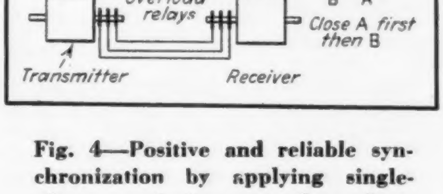


Fig. 4—Positive and reliable synchronization by applying single-phase excitation to three-phase synchro-tie

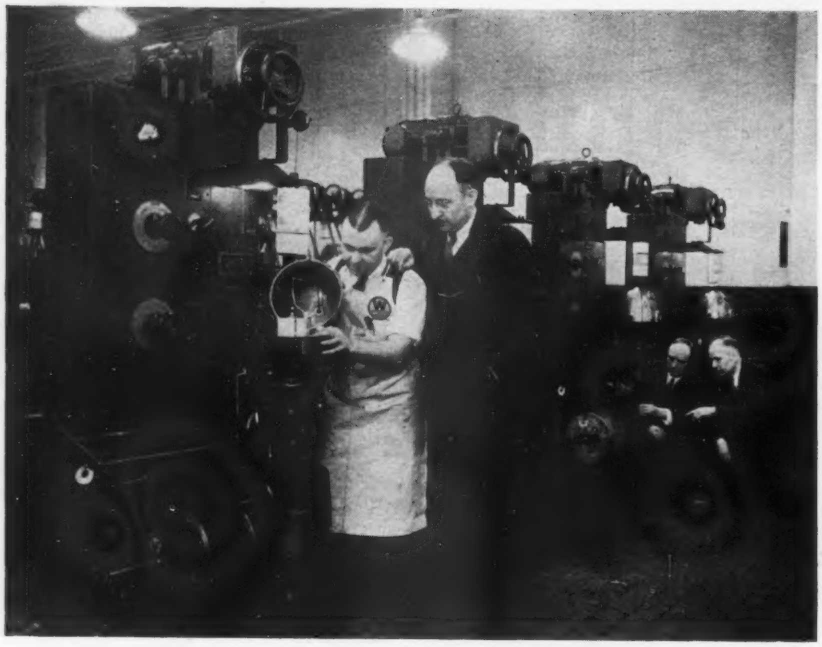


Fig. 5—Synchro-tie is electrical gearing

By using a six-pole transmitter on the capstan and a two-pole receiver triple speed is obtained on the gearless flier that wraps a helical "lay" of insulating ribbon around copper wire. The drive insures a uniform wrapping regardless of wire speed and eliminates the backlash common to gear-driven machines and slippage of belt drives.

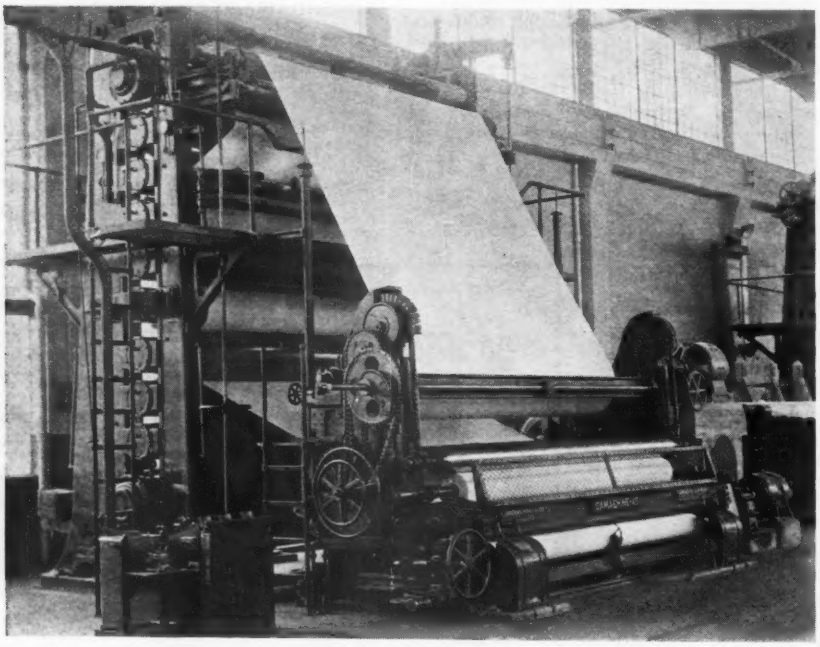


Fig. 6—Constant tension by a synchro-tie system

Paper kept at exactly the same tension as it emerges from the super calender, regardless of speed. A frequency-changer control, see Fig. 2c.

tion is readily available regarding the characteristics of general-purpose induction motors the wide range of operating requirements and the peculiar characteristics of the synchro-tie units make it very difficult to prepare information in advance which will cover all applications (see Fig. 3).

Example of synchro-tie selection

Assume a shaft driven from 300 to 900 r.p.m. by any means and the need of tieing to this shaft a conveyor requiring 2 hp. at 900 r.p.m. with the same torque at the lower speeds. What rating of synchro-tie units should be used and should they operate with or against the field?

The torque at 900 r.p.m. equals

$$\frac{\text{hp.} \times 5{,}250}{\text{r.p.m.}} = \frac{2 \times 5{,}250}{900} = 11.7 \text{ ft.-lb.}$$

This same torque must be developed continuously from 300 to 900 r.p.m. This value of torque is the maximum permissible from a temperature standpoint, but at higher speeds is quite liberal. Since few machines operate much of the time at minimum speed the use of two motors of this rating (normally 5 hp., 1,750 r.p.m.) is satisfactory from a heating standpoint. With a starting and accelerating torque of 50 ft.-lb. available there should be no question about acceleration, but the starting torque and rate of acceleration as determined by the main drive should always be investigated.

If dynamic braking or quick stopping is obtained on the main drive this should also be considered. If dynamic braking is used and the load driven by the receiver has a high inertia the receiver may become a transmitter during the decelerating period and the torque then available (rotation with field) is much less, especially at higher speeds as indicated in Fig. 3b. Conveyors and most machines have a comparatively high ratio of friction to inertia, but machines using anti-friction bearings and having a high inertia should receive special consideration.

Since the maximum speed of the above drive is only 50 per cent of the synchronous speed of the four-pole machines operation with the field is entirely satisfactory. If operation at speeds above 1,000 or 1,200 r.p.m. is desired it would be necessary to operate against the field, although in certain cases it may be more desirable to use two-pole windings, which thus permit operation up to 2,000 r.p.m. with the field.

Control and protective equipment

Synchro-tie units are synchronized or connected to the alternating-current power supply only when both units are at zero speed. Any angular displacement may exist when connected to the supply, and if three-phase power is applied and the angle is large a high torque is developed. This torque may cause one or both rotors to pass through the zero position at such a speed that if the machine friction is low and the inertia high the restraining or transmitter torque will be exceeded, and the rotor instead of swinging back to the zero position will accelerate toward synchronous speed. If the transmitter is restrained by the load of the main drive the receiver will run up to approximately synchronous speed, but if both machines are free they will run up to some high but indefinite and fluctuating speed. In order to obtain a more positive and reliable synchronizing single-phase excitation should first be applied, followed immediately after by three-phase power as indicated in Fig. 4. The entire control may readily be made automatic using a timing relay for the proper sequence, and if desired this control may be interlocked with the control of the main drive so that the synchro-tie units are energized before the main motor is started, and de-energized after it is stopped.

Due to the fact that synchro-tie units may operate at any speed and, in fact, remain stationary with normal three-phase voltage excitation the most

[*Continued on page* 112]

A SURVEY

of the problems, policies and practices affecting the market for commercial

AIR CONDITIONING

By **HENRY G. DOOLEY**
Associate Editor

A NEW outlook toward the air-conditioning load is seeping rapidly through the operating utility companies. Management is seeking the best answers to an array of economic problems presented by this load.

Sales executives are appraising the cost of securing this business, its revenue possibilities and operating characteristics, as well as the all-important effects on the company's relations with the air-conditioning customer, the dealer, contractor and the equipment manufacturer.

Engineers, and particularly the system planners, are bending over their distribution system maps with a new interest for this air-conditioning load is introducing new problems. These demands of compressor and fan motors are congregating in the downtown sections or out in the heart of the suburban shopping center, places where it takes revenue to justify plant additions.

The most rapidly growing air-conditioning load is the commercial installation, as shown on the following page. This is the installation, usually under 25 kw., for the beauty parlor, taproom, ladies' ready-to-wear shop, doctor's office, restaurant and sundry other establishments served on the small power or commercial rate schedule.

The accelerated rate at which this load is coming on the lines, the fact that there is a divergence of opinion as to the desirability of the load and an apparent lack in many quarters by utilities and manufacturers of a mutual appreciation of each other's problems dictated the need for a discerning survey of the more important aspects of commercial air-conditioning load development.

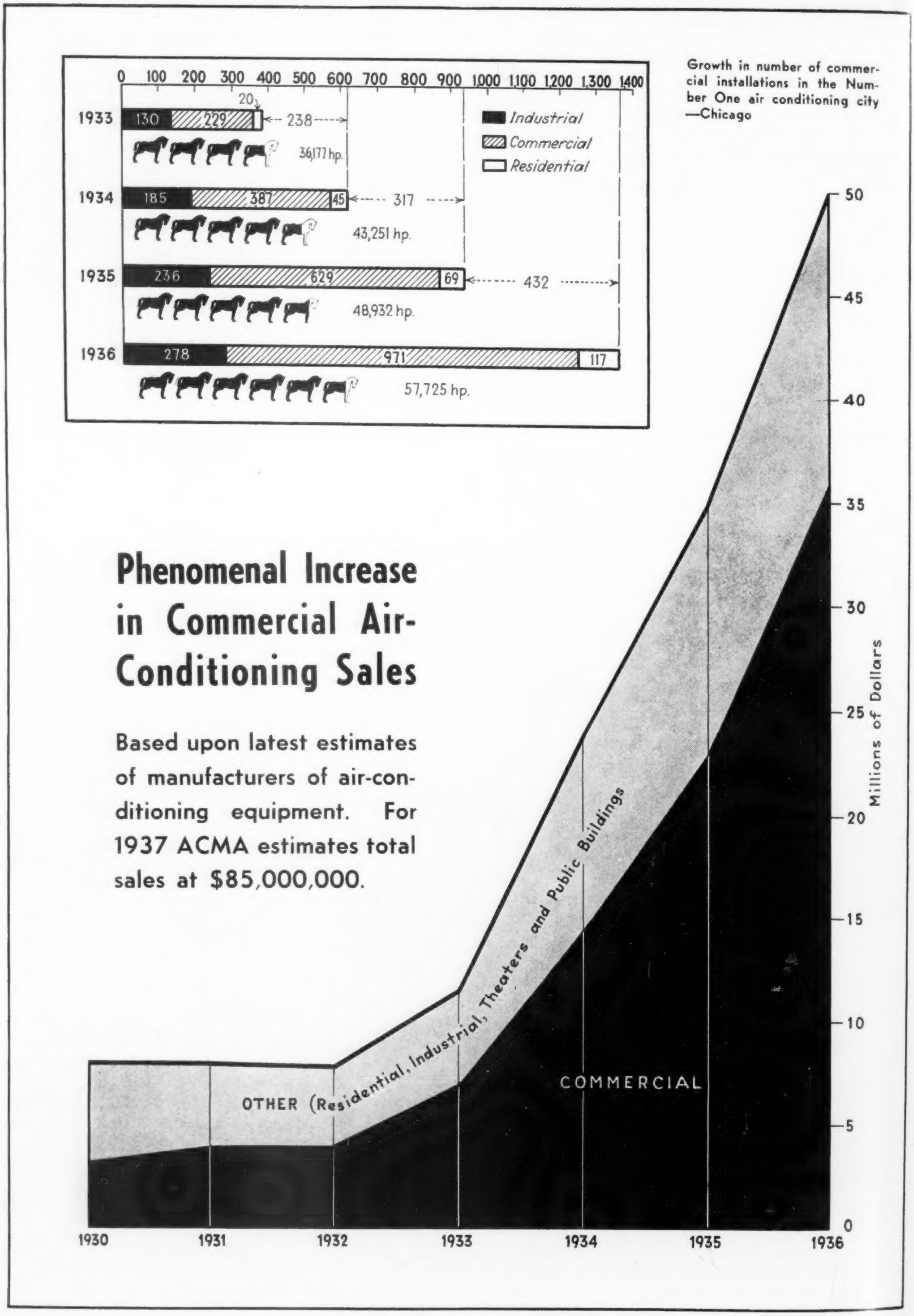
This survey is a blend of confidential expressions of policy and practice together with suggestions from electric utilities in 34 states and a number of the leading manufacturers, secured through personal conferences and supplemented by questionnaires.

While this survey has developed many divergent opinions, policies and practices, it has also shown conclusively the vital position occupied by the utility today. For "whether the utilities wish to assume the rôle or not, they stand in the position of consultants between the bid and the sale" of all commercial air-conditioning equipment going on their lines. Indeed, a nice tribute is thus paid to the utility industry by the prospective air-conditioning customer who daily turns to his competent friends in the power company for the unbiased answer.

Therefore, even though air conditioning is a new development that has caught the public imagination and has led many manufacturers with no air conditioning background to try to get in on the ground floor, the utility company is in the position of deciding to a considerable degree just how fast and where commercial air conditioning is to advance in its territory.

UNLIKE electric cooking and refrigeration, on which the pioneer selling work was done almost single handed by the utilities, engineering considerations require a cooperative development of the air-conditioning market. Our survey has shown that the utilities will promote the sale of commercial air-conditioning installations, but they do not generally assume responsibility for their operation. While they will do all they can properly to advise the customer, they are not inclined to install, finance or service the air-conditioning equipment.

It was felt that a frank presentation of the problems and the thinking of the industry might clarify the situation and facilitate the co-operation between utilities and manufacturers so necessary for a mutually profitable development of the market.



Growth in number of commercial installations in the Number One air conditioning city—Chicago

Phenomenal Increase in Commercial Air-Conditioning Sales

Based upon latest estimates of manufacturers of air-conditioning equipment. For 1937 ACMA estimates total sales at $85,000,000.

SUMMARY of the views held today by the management, the sales and the operating forces of public utility companies, relating to the practical influences now controlling the commercial air conditioning situation

1. Have you aggressively promoted commercial air conditioning? *Or have you taken what has come in to you? Have you let dealers or manufacturers take the lead?*

UTILITY companies for the most part report that they are promoting commercial air-conditioning sales. Many, in fact, are promoting the business aggressively.

There is a certain amount of inertia toward air conditioning, but the reports indicate that the utilities are finding themselves forced to take a hand in the orderly development of the market. The equipment is being sold to the commercial customer, is being connected to the utility lines and so must be served. Therefore, the utilities find that they cannot be passive in this connection, if only to insure the selection of properly designed equipment made by reputable manufacturers and adequately engineered for the customer's installation.

Local promotion agency

In fact, the utility company today is the principal agency, directly or indirectly, of local promotion of commercial air conditioning. In communities where there is no pronounced interest in this market it will be found as a whole that the utility is passive. It would appear, therefore, that the manufacturer and distributor are unable or unwilling to undertake the pioneering job of promotion of the local market without the active support and guidance of the local utility.

Utilities report that the customer usually leans upon them for advice on bids, standing of bidder, equipment performance and operating costs. Moreover, the utility is looked to by the customer for aid in securing service. Promotion of commercial air conditioning, therefore, has been taken up by the power companies not only as a load-building activity but also in the interests of customer protection.

Utility promotion of commercial air conditioning is taking many forms. Among the more popular are:

Compilations of prospect lists; selection based upon the likelihood of mutually profitable and satisfactory relationship over long term.

Direct mail campaigns.

Newspaper advertising.

Completely informative booklets and brochures for prospective customers.

Formation of local air-conditioning councils and leagues; with subsequent active and co-operative participation.

Advertising in local magazines, on billboard displays, in radio programs.

Informative talks to local lay clubs (composed of ultimate users).

Installations in company stores, offices, model homes.

Sales contacts with prospective users by company salesmen.

Some companies go so far as to follow up every item of direct mail advertising with a salesman's call. In such cases, which are surprisingly numerous, the salesman finds out whether the customer is a suitable prospect that should be developed into an air-conditioning customer. Such an appraisal becomes of great benefit to the utility company, the dealer,

BAKERY—A ventilating duct system provides clean air in Schlosser's Bakery, Chicago. Installation totals 1$1\frac{1}{2}$ hp.

Commonwealth Edison Company

TAPROOM—A ceiling unit in the taproom of the Powers Hotel, Rochester, N. Y., provides filtered air for some 2,500 sq.ft. of floor area. Connected load, 11 hp.; estimated consumption 8,800 kw.-hr.

Rochester Gas & Electric Company

Commonwealth Edison Company

DRESS SHOP—Ladies' dresses are sold and fitted in comfort in Gertrude Kopelman's dress shop, Chicago. Central system totals $5\frac{1}{2}$ hp.

distributor and manufacturer, and of course to the customer himself.

It is interesting to note the number of companies which say they started the air conditioning ball rolling one year ago, two, three or four years ago, and then passed this responsibility to another agency. This agency might be an air conditioning council in the community or a local association, a dealer-contractor group or even the manufacturers. In such instances where the active sales solicitation may have been taken over by others, the utilities have continued aggressive promotion.

2. Do you have an air-conditioning department or bureau? *Does it pay? How many men? Are these air-conditioning men trained in utility sales or utility men trained in air conditioning?*

UTILITIES active in air conditioning as a rule have a department for this work with anywhere from one full-time man engaged in promotion, sales or engineering to a large department with specialists. Among the latter will be found those companies that are promoting air conditioning on a year-round basis.

The form of the question was confusing to some of the companies. They did not know whether it was intended to refer to an intra-company group or to a co-operative group outside the company with which the company was actively co-operating. These outside groups are all referred to in our text as councils.

The intra-company group

The intra-company group, as might be expected, is geared as to number of personnel and time devoted to air conditioning very closely with the amount of air conditioning horsepower on the company lines and the amount currently coming on to the lines.

The men, for the most part, are utility men trained in air-conditioning work. Only a few companies have attempted to build this market with air conditioning men brought in from the outside.

The universal custom among the companies is definitely to consider the air-conditioning load as another load subject to development by regular utility power salesmen, many of whom are reported to have received a special training in air-conditioning engineering.

Does it pay?

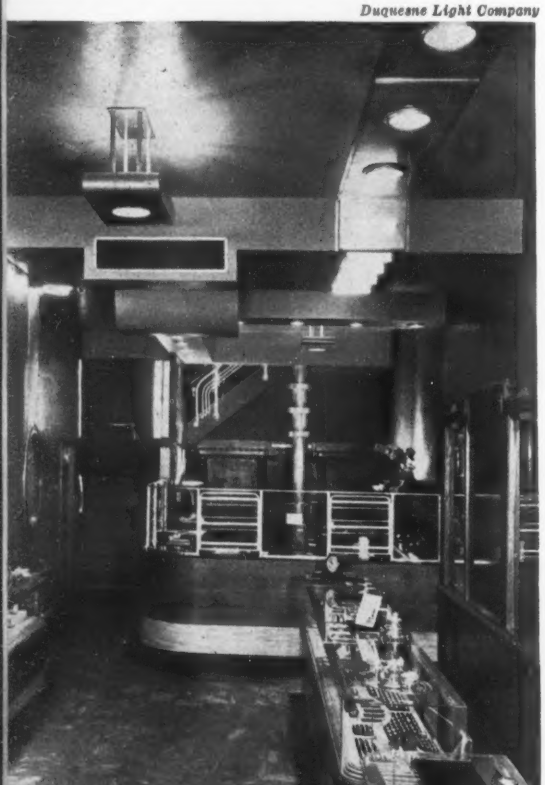
The most interesting angle on this question may be the fact that so few companies answered the question at all. Those companies which did reply sounded one common note by indicating that the department did pay because *it was held to a paying basis in terms of air-conditioning revenue.*

This statement deserves some further analysis. In one subdivision are those companies which have reached the position where they can confine their activities to promotional work coupled with an analysis of the customer's equipment needs (usually requires one man-day per job) plus some direction of the progress of bids.

Many of these companies feel that their air-conditioning work does pay dividends, because the department does concern itself only with the specific matters enumerated above, does keep its fingers on practically all that is going on, but the bulk of the time-consuming detail is taken over by the co-operative group outside the company, by the dealers and contractors and manufacturers.

In the other subdivision are those companies which, satisfied with the revenue from air conditioning and its relation to their own particular situations, see the load going on their lines on an increasing scale. To them, any load taken on standard rate schedules at a satisfactory volume is considered to justify the expenses they are incurring.

Duquesne Light Company



JEWELRY STORE—Throughout the year conditioned air is distributed through ducts to two floors of Louis DeRoy & Brothers, Pittsburgh. System totals 6 hp., uses an estimated 5,000 kw.-hr. yearly

3. Do you encourage dealers to push air conditioning? *If there is a co-operative arrangement, how does the company co-operate (demonstration offices, advertising allowances, etc.)?*

ALMOST all of the utilities report that they are encouraging dealers to promote air conditioning. Not only does this mean help for the established dealers but also efforts to interest other dealers in the potentialities of the market.

Where there are dealers equipped to take on air-conditioning business the utility companies are passing along to them all of the data and information available on prospective air-conditioning customers. Where there are no qualified dealers the companies pass along this information direct to the manufacturers, usually on some basis of rotation, and under an arrangement designed by the utility management to operate without bias, favoritism or undue influence of any nature.

In brief, in approaching the dealer-contractor problem as it bears on air-conditioning development the utilities are generally working toward the standard arrangement of dealer relations now prevailing throughout most of the industry.

Councils

In replying to the question on co-operating organizations, numerous companies referred to their air-conditioning council or association, league or bureau. It is in conjunction with these councils that the utility companies exercise most of their broad helpfulness and general co-operation in the proper development of air-conditioning installations.

Joint advertising using numerous media, periodic meetings with all members of the council, attention to the standards of membership and delivery of customers' inquiries to the members of the council are evidences of the degree of encouragement extended to dealers by utility companies; demonstration offices, demonstration shops, advertising subsidies, minor allowances on wiring and such measures are employed by the companies in varying degrees.

AIR CONDITIONED FOR YOUR COMFORT

Potomac Electric Power Company

DEPARTMENT STORE—Only commercial air-conditioning installation in Washington, D. C., to utilize equipment for ionizing the air is the Hecht Company. Connected load, 750 hp.; annual kw.-hr., estimated 750,000

4. How much do you get from commercial air conditioning (cents per kilowatt-hour, dollars per kilowatt-year)? *Do you feel that price is compensatory, and why?*

THESE questions and the next set, based upon the general advantages and disadvantages of commercial air-conditioning load to the utility companies, not only uncovered the differences of opinion which characterized replies to other questions, but the length of the discussion and its vigorous tone leave no doubt that the industry has by no means reached a general conclusion on the desirability of the commercial air-conditioning load.

This conclusion stands, even though many companies declare they are out after every kilowatt of air-conditioning load they can connect to their lines.

Today utility companies are saying one of three things about commercial air-conditioning load. One group says: "We are out after every kilowatt we can get." A second group says: "We are taking what comes in to us." A third group, which expresses itself verbally in an abrupt expression of only four short words.

HOTEL—Manhattan's Hotel St. Regis already has 180 guest rooms and its six public spaces air conditioned the year 'round. Present equipment, 75 hp.; 94,200 kw.-hr. consumed the past seven months.

in writing, says: "We do not favor commercial air conditioning load."

The replies for the most part are lengthy. They treat of cents per kilowatt-hour, dollars per kilowatt-year, incremental revenue, rate schedules and rate forms, annual load factors, seasonal loads, summer valleys against December peaks, and *vice versa.* Underground investments, network loads, peak responsibilities and sales policies over a decade dot the replies.

Revenue

The majority of the reporting companies are of the opinion that they receive $20 per kilowatt per year from commercial air conditioning. This figure is not an average, but is simply the figure occurring with greatest frequency.

Some of the other replies, selected to show a cross-section of the returns, both for geographical diversity (22 states) and distribution of replies, are as follows:

1¾ cents per kw.-hr..........	$15.75 per kw.-year
1.25 cents..................	20.00
2 cents.....................	60.00
*...........................	18.00
*...........................	25.00 to 50.00
3 cents..............Roughly	15.00
7 cents to 7 mills based on our rate schedule	*
2 cents to 6 cents..........	12.00 to 24.00
1 cent to 4 cents...........	*
2 cents to 3 cents..........	20.00
3.25 cents..................	*
2 cents to 5 cents..........	35.00
*...........................	20.00
4 cents.....................	*
1.4 cents to 4.3 cents......	*
Average 2.7 cents...........	11.00 to 25.00 aver. $11.50
*...........................	20.00
1.96 cents..................	15.02
1 to 2 cents................	*
3½ cents....................	70.00
1.1 to 2 cents..............	*
1.8 cents...................	12.62
3 cents.....................	*

* No data supplied.

Three points are noteworthy: First, perhaps one-half of the reporting companies apparently do not know for a certainty what is their revenue from an air conditioning installation. Secondly, a half of these spoke very definitely along these lines: "Our air conditioning is served on a regular rate schedule. If our rate schedules are soundly conceived and properly designed, we are satisfied with the revenue, whatever it is and regardless of whether it is air conditioning or any other load."

Critical appraisal

Thirdly, many companies are apparently appraising their air-conditioning loads critically. Numerous replies stress the fact that their revenue is compensatory because it is off-peak. Others say it is compensatory because it is "incremental" revenue. Still other companies report the revenue is "satisfactory," but do not say whether it is compensatory.

This leads us to the companies which say they lon't want any more air-conditioning load. Their comment, in the aggregate, runs along these lines:

"We don't want any more air-conditioning load than we have because we are losing money on the present load. Suppose we do get $15 or even $20 per kw.-year. This is not enough to repay us for the increased facilities we have to install to serve this added air-conditioning load.

"We would much rather go out after lighting load and get $40.

"Our systems are becoming loaded. These new kilowatts of load are going to require new plant facilities and $15 to $20 per year won't support new facilities.

"Worse than that, most of our commercial air conditioning has been added in the downtown section and is served from the network. It costs money to increase its capacity and $15 to $20 per year is not enough to justify the increases.

"The average commercial customer thinks in terms of only summer air conditioning and this has an annual load factor of only 12 per cent. It may be that our summer valley will be changed to a summer peak condition. If this is true, then we face the increase in system facilities.

"Year-round conditioning is much better, gives a load factor of 35 per cent. But we are finding that with today's air conditioning the fan portion of air conditioning gives us a better hour-use than the compressors and we actually sell more fan kilowatt-hours than compressor kilowatt-hours. We dislike to 'drag our feet' with respect to any load presented to our lines, but we must work a kilo-

DRUG STORE—One of fifteen air-conditioned drug stores operated by the Read Drug & Chemical Company, Baltimore. Ventilation, summer cooling and dehumidification are provided by the 12 hp. of equipment, using an estimated 7,500 kw.-hr. per season

Consolidated Gas, Electric Light & Power Company of Baltimore

SPORT COATS

CLOTHING STORE—A duct system is used in this store of Howard Clothes, Inc., at Jersey City for summer air conditioning. Connected load is 6.5 hp.; estimated annual usage, 3,000 kw.-hr.

Public Service Electric & Gas Company

watt for all it is worth to stay in business."

It will be noted that the companies which adhere to this view touch on two points: (1) The relation of peak loads to their network capacity and (2) load factor. Both of these points would apparently be minimized if air-conditioning equipment were used more hours. This might be accomplished by different design of equipment, by extending the customers' habitual use of their air-conditioning equipment or by more attention on the part of all concerned to installations which use the service more hours per year.

Consolidated Gas, Electric Light & Power Company of Baltimore

BUTCHER SHOP—Main section of one of two butcher shops operated by Schreiber Brothers, Baltimore, and air conditioned the year 'round. An estimated 13,000 kw.-hr. is consumed by 17 hp. of equipment

5. What disadvantages or problems to the company are introduced *by the growth of commercial air-conditioning loads? What advantages or benefits does it promise?*

IN THE main utilities are disposed to view commercial air conditioning as a desirable load in spite of its present poor load factor. The rate problem is not serious at the moment, but should this load develop to a point where it taxes the capacity of the downtown system, it is obvious that something will have to be done to make this load pay for the needed extra investment. It would appear that most of the utilities are expecting that before such a contingency occurs means will have been found whereby the customer will use air conditioning the year around.

The most important point stressed by the utility companies was the fact that the bulk of the air-conditioning capacity is required during the summer season, while in general company peaks occur in the winter time. In this connection it is interesting to learn that one of the most enterprising utilities has found for every 100 kw. of air-conditioning load that comes on the system in the summer time it is deriving about 25 kw. of load in the winter time. It was pointed out that while the 25 kw. of winter load does come at rather unfavorable times, the company is perfectly willing to take on 1 kw. of air-conditioning load in the winter time for 4 kw. over most of the summer.

A great many companies laid great stress upon the fact that the commercial air-conditioning load promises to become an all-year load. In fact, this is one of the important considerations which utilities have in mind when they are considering air-conditioning equipment for their customers.

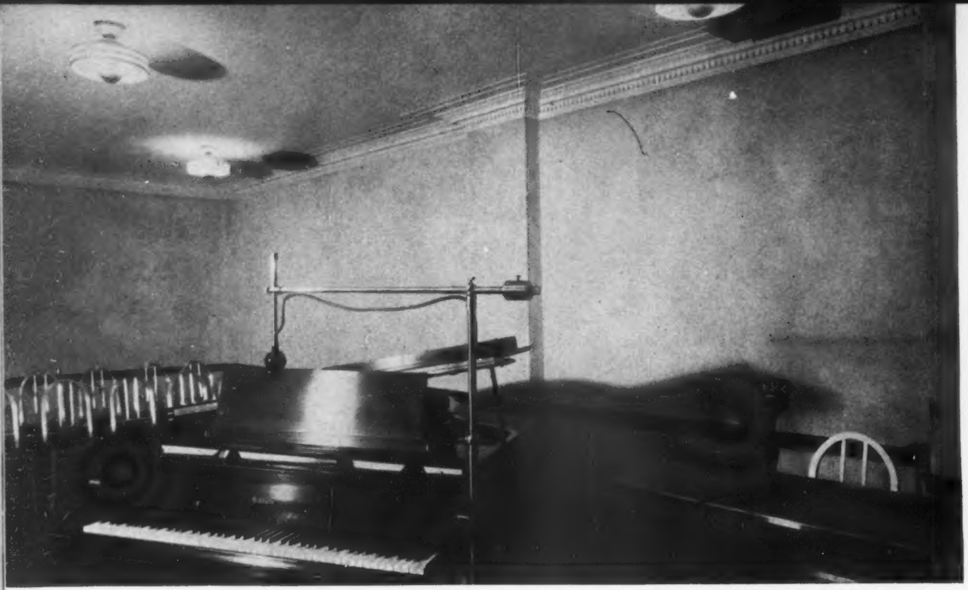
Comments from three companies upon the status of commercial air conditioning with relation to the company peak are so broad and discerning that they are worthy of inclusion in these general comments. Said the first company: "We see no particular disadvantages or problems raised by the commercial air-conditioning load. Rather, we think the load has many advantages, that it comes on at a compensatory rate, comes on the system at a time when we need it—in the summer time. It lifts our general load factor. We have noticed one characteristic of year-round air conditioning which we consider very favorable; that is, for every kilowatt arising from air-conditioning equipment on our system in the winter, when we reach our peak, 3 or 4 kw. is imposed by our equipment in the summer time when we have more than enough idle capacity.

"We doubt very seriously if our summer load would ever exceed our winter load, due to air conditioning or anything else, because our load building is constantly increasing our winter peak and the air-conditioning load could not catch up with it. We will take any load we can get for we believe our rates and rate forms are correct and that therefore the service comes on at a truly compensatory rate."

A second company, stressing the advantages of the additional revenue that comes at the time of the year when

OFFICES—One of the offices in Esslinger's, Inc., new building in Philadelphia. Air is cooled, cleaned and dehumidified in summer, cleaned and humidified in winter. Equipment totals 44 hp.; consumes an estimated 130,000 kw.-hr. yearly

Philadelphia Electric Company



Potomac Electric Power Company

RADIO STUDIO—Separate central units provide year-round air conditioning for station WOL and the Heurich Building housing it in Washington, D. C. Connected load, 54½ hp.; annual kw.-hr., 69,144

the system demand is not at a peak, pointed out that the installation of summer air conditioning often brings with it a fan load which carries on throughout the year.

A third company said: "We realize that there are some disadvantages to the air-conditioning load. However, we feel that they are disadvantages which are of interest to the engineers rather than to the sales and merchandising departments. We might forego load building in lighting because it comes on the peak. We might stop load building in ranges and water heaters because it is claimed that the diversity is not as high as has been thought. However, our policy is to go ahead and sell every kind of load that we can get onto our system, feeling that the rate department will take care of the price and revenue and that the engineering department will take care of the facilities."

Inasmuch as a great many of the reports will reflect the viewpoint of utility operators in the medium-sized communities, it is not unusual, perhaps, that a number of companies mention the concentration of commercial air conditioning loads upon their downtown systems. One company, for instance, mentioned the fact that new three-phase services are required by air-conditioning loads in its downtown systems, and while the company has no objection to installing three-phase, it is desirous of changing the air-conditioning installations so that the three-phase service and all of the appurtenant equipment will be used more than four months per year.

Because air-conditioning equipment uses excess capacity which might be reserved for other purposes and gives only a low return, some utilities are making some form of charge to their customers for the months that the air-conditioning equipment is installed but not used, and this seems to be causing difficulties which sooner or later will have to be ironed out. In fact, one company frankly predicts that most of its commercial rate structures will be altered to take care of this particular point.

An angle which is stressed by companies depending upon hydro power is that the air-conditioning equipment used in the summer time comes on the line during the dry weather period.

6. Do your customers come to you for advice on their air-conditioning installations? *Why? How far do you go with specific advice? What types of commercial air conditioning do you prefer?*

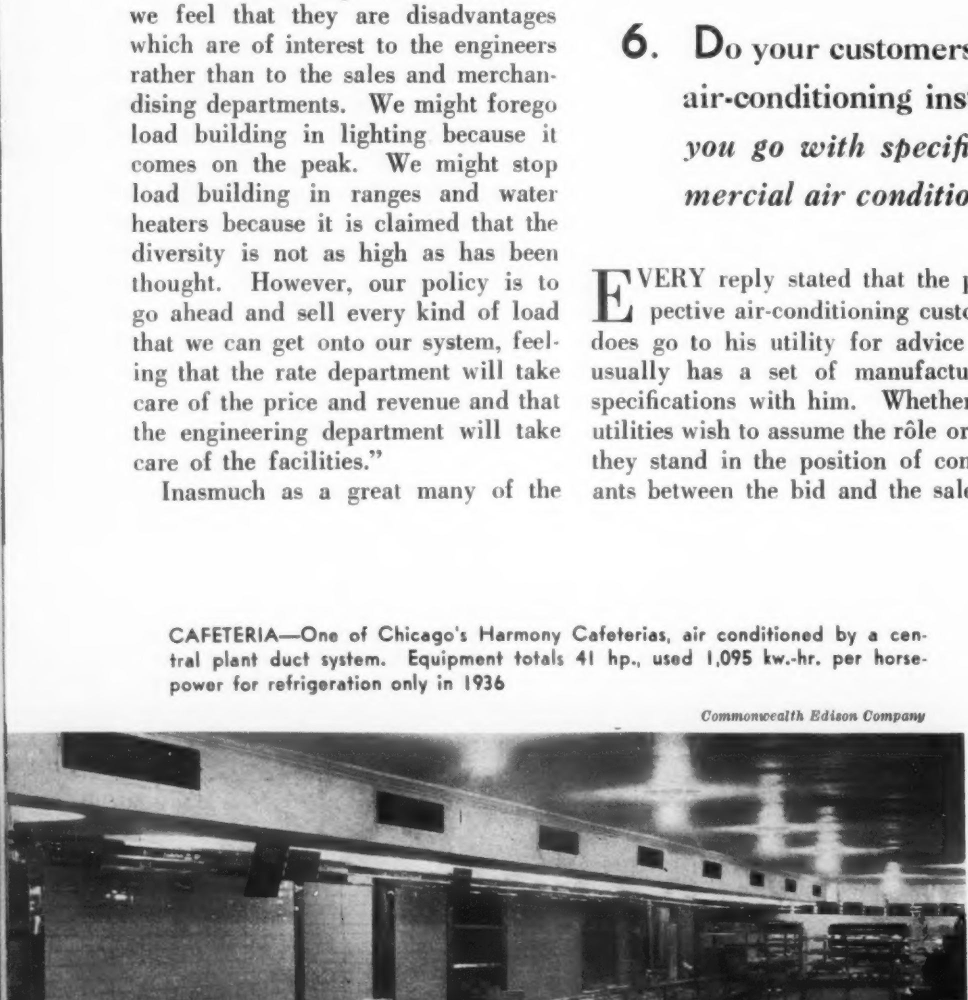
EVERY reply stated that the prospective air-conditioning customer does go to his utility for advice and usually has a set of manufacturers' specifications with him. Whether the utilities wish to assume the rôle or not, they stand in the position of consultants between the bid and the sale.

"Because they feel we are friendly to them and unbiased with respect to equipment" is the almost universal reply to the second question—"Why?" That the customer's trust is well placed is evident by the careful emphasis utility companies place upon adequacy and performance in passing upon any given air-conditioning installation. In many cases the services of consulting engineers are recommended to the prospective customer.

Other companies well acquainted with the engineering reputation of a number of air-conditioning equipment manufacturers assemble the bids from these particular manufacturers and say to the customer: "Any one of these is probably all right and we'll look them over for you." Subsequently the customer is advised of three or four installations in town which have been installed by different manufacturers, and he is advised to go out to these installations and look them over him

CAFETERIA—One of Chicago's Harmony Cafeterias, air conditioned by a central plant duct system. Equipment totals 41 hp., used 1,095 kw.-hr. per horsepower for refrigeration only in 1936

Commonwealth Edison Company



self and talk with the owners about them.

Virtually none of the power companies make any installations and but few of them make complete engineering layouts. From the replies, it was evident that in general the utilities confine their efforts to advisory services, recommending consulting engineers or others for detailed layouts and specifications. The interest of the utilities would appear to be that of securing for their customers equipment best suited to their needs and which would be the most economical.

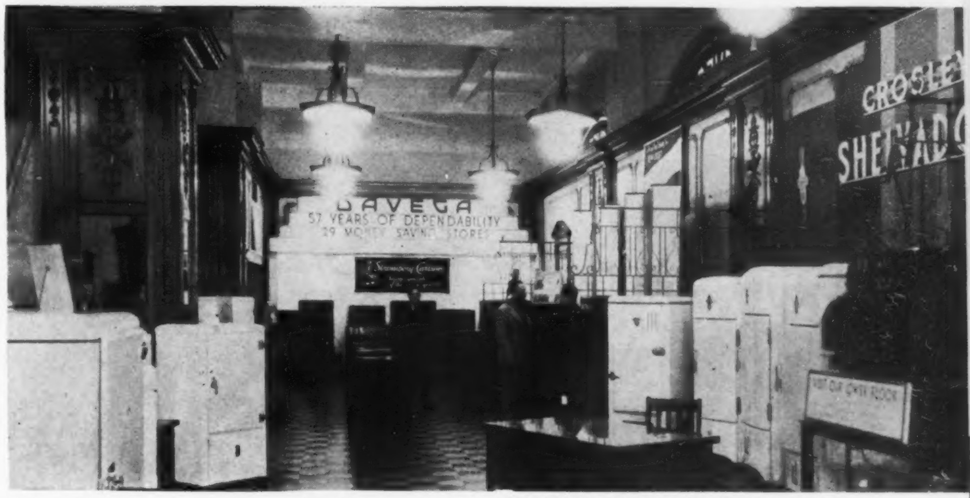
While those replying were hesitant about showing any particular preference as to types of equipment, it was obvious that the utilities prefer equipment where more emphasis is placed upon ventilation and humidity control and less upon low temperatures. A number stated a preference for mechanized refrigeration, while certain replies emphasized correct control. In general, the utilities have no equipment preference, being satisfied to see that the customer gets equipment of a size and kind best suited to his needs.

A very few companies claim the best arrangement for the utility is to deal with one or two manufacturers, but they are very small numerically.

Strangely, perhaps, no air-conditioning council or other central group in the community seems to be invested solely with the responsibility for advising the customer upon his prospective installation.

Oklahoma Gas & Electric Company

GRILL—A view of one of the three dining rooms comprising Herman's Grill, Oklahoma City. Entire establishment, with 2,526 sq.ft. of floor space, is air conditioned by 32-hp. central plant on floor above



Public Service Electric & Gas Company

SPORTING GOODS STORE—Davega City Radio, Inc., of Newark is equipped for summer air conditioning. A duct system totaling 31.75 hp. uses an estimated 13,000 kw.-hr. annually

7. Do you install commercial air conditioning? *If not, who does install it? Is the present installation arrangement satisfactory?*

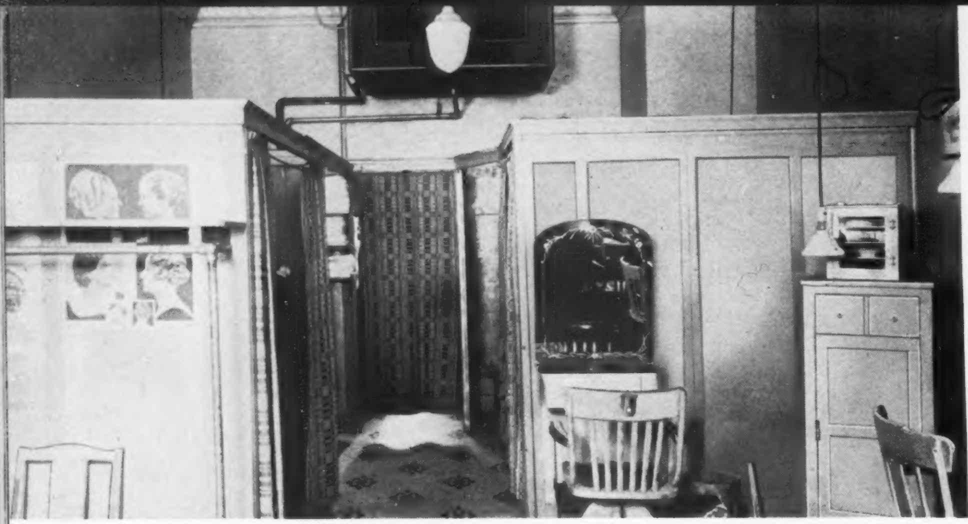
IT MAY be said that utility companies are not installing commercial air-conditioning equipment. Installations are being made under the direction and upon the responsibility of the dealer or manufacturer or his designated agent, and from the utility company standpoint this present arrangement is satisfactory.

One general exception to the foregoing is the tendency of numerous companies to "install" the self-contained units requiring no ducts. A few companies will handle an air-conditioning job from start to finish, but they constitute only a score or so.

Where the utilities, however, have been called in as consultants, or in an engineering advisory capacity, they check over all proposals and in many cases check the job during its installation as part of their service to the customer. The feeling is quite general among utility companies that the installation rests in the hands of manufacturers and dealers.

FURRIERS—Here is a duct system installation in the store of Max Siegel & Son, Chicago. System includes 9 hp. of equipment

Commonwealth Edison Company



Commonwealth Edison Company

BEAUTY SHOP—A suspended-unit system totaling 5 1/3 hp. is installed in the Charming Beauty Shop, Chicago. Energy consumption in 1936, 457 kw.-hr. per horsepower

8. Do you finance commercial air-conditioning installations? *If so, what policies are you following? If another agency takes care of the financing, how is it working out?*

GENERALLY speaking, the utility companies are not financing commercial air-conditioning installations. Some other agency, ofttimes the Federal Housing Administration, or a commercial financing corporation, assumes all the responsibility. Financing by the manufacturer or his distributor, or the dealer, are mentioned. In all cases reported the arrangements are working out satisfactorily.

The only important exception appears in the case of the self-contained or unit installations sold by the utilities direct to customers.

9. Are you called upon to service commercial air-conditioning installations? *If so, what general policy do you observe? If some one else takes care of the servicing, how does it seem to be working out?*

AS A rule, the utilities are not called upon to service commercial air-conditioning installations. The almost universal arrangement is for the manufacturer or the distributor to assume all responsibilities for servicing, and this arrangement seems to be entirely satisfactory. However, these utilities answer emergency calls and point out the source of the trouble to the customer. They, of course, do assume the responsibility for servicing the air-conditioning equipment which they themselves have sold and a number of the companies will even make minor adjustments to commercial air-conditioning installations regardless of who sold the equipment to the customer. In some companies this service is charged for at base cost.

One comment in connection with this point seems to be of particular importance, in view of its implications. The answer to the question was as follows: "Each dealer sells and services his own job. So far this method is working very satisfactorily because only reliable firms have taken on air-conditioning sales." This answer to the question becomes of importance when it is remembered that this company, in common with most of the other utilities, is obliged under present circumstances to assume a rather important rôle as an adviser to the purchaser of air-conditioning equipment. Therefore, if a company exercises care in the dealers which it recommends to the customer, it may expect to profit by being relieved to a greater extent of servicing expenses.

10. How can manufacturers better co-operate with you? *What should dealers and contractors do to be of more effective help in your situation?*

IT IS interesting and encouraging to note that all the companies reporting expressed their opinion that the dealer and contractor situation was satisfactory. The situation with respect to manufacturers was generally considered to be quite satisfactory considering all the circumstances, and this again may be due to the fact that the utilities are exercising discrimination in the number of dealers and manufacturers with whom they co-operate. It should be particularly remarked that this care on the part of the utility companies in selecting the manufacturers and the equipment for recommendation to customers has paved the way for the avoidance of a great many mistakes in selling, servicing and financing and in dealer and contractor relations.

As might be expected, the utility companies would like to see more well-trained dealers, they would like to have them better staffed and they would like to see them properly financed before they are brought into the general air-conditioning picture by a manufacturer. A great many companies mentioned the necessity for competent air-conditioning salesmen in the dealer-contractor organizations and some companies have asked that there be more dealers.

Other elements of co-operation desired by the utilities are as follows:

From dealers—Price maintenance; adequate installations; compliance with utility service rules, particularly with respect to starting currents and self-contained units; more aggressive promotional effort; more familiarity with rates.

From manufacturers—More national promotion with consumer viewpoint and less technical promotion; more dealers; more help of a sales and engineering nature for the dealers; more latitude for dealer sales in terms of size of installations; insistence that installations be adequate and completely engineered jobs.

THE POSITION of the utility company today in the commercial air-conditioning industry and specific suggestions for co-operative development of this load along mutually profitable lines is discussed by manufacturers of commercial air-conditioning equipment

IN ADDITION to the analysis of the commercial air-conditioning market from the viewpoint of the electric utilities, the manufacturers of this type of equipment also were asked to comment on the place of the power companies in the development of this market and indicate avenues suitable for additional co-operation.

The utility company is a very important factor in the development of the commercial air-conditioning business, say the manufacturers, particularly as to its rendition of promotional and advisory services.

Both the promotion and the advice should be of a high order, it was said, if the air-conditioning business is to be built soundly and profitably for all.

In the promotional field direct-mail campaigns by operating companies are highly favored. The offices, especially of the larger companies, should be air-conditioned at least in the summer. Another very important suggestion was that more of the power companies utilize salesmen for personal solicitation of prospects.

As evidence of their eagerness to co-operate with the utility, certain of the manufacturers cited: (1) The formation of their association to protect proper air-conditioning standards; (2) the liaison committee with the Edison Electric Institute; (3) retention of ex-utility operators as liaison agents between the manufacturer and the utilities; (4) the preparation of complete up-to-date manuals on air conditioning, particularly for power company salesmen.

Aiming for better co-operation

To any one privileged to solicit the views of utility companies and manufacturers it is a happy augury that both groups seek better co-operation toward the common goal of dependable equipment, adequate and applicable for the specific job and in a properly engineered installation.

In seeking out opinions which would promote even greater co-operative effort, many viewpoints were offered. "The utilities should crusade for high-grade (commercial air-conditioning) products and soundly engineered applications," said one manufacturer.

Concentrate on securing the basic business data," said another, pointing out that only the utility company enjoyed customer confidence to the degree necessary to find out, for example, that in a ladies' ready-to-wear shop dry-cleaning bills (due to perspiration) were four times the total bill for air-conditioning. Apparently only the utility can draw from the customer the information which proves the dollars and cents value of commercial air-conditioning.

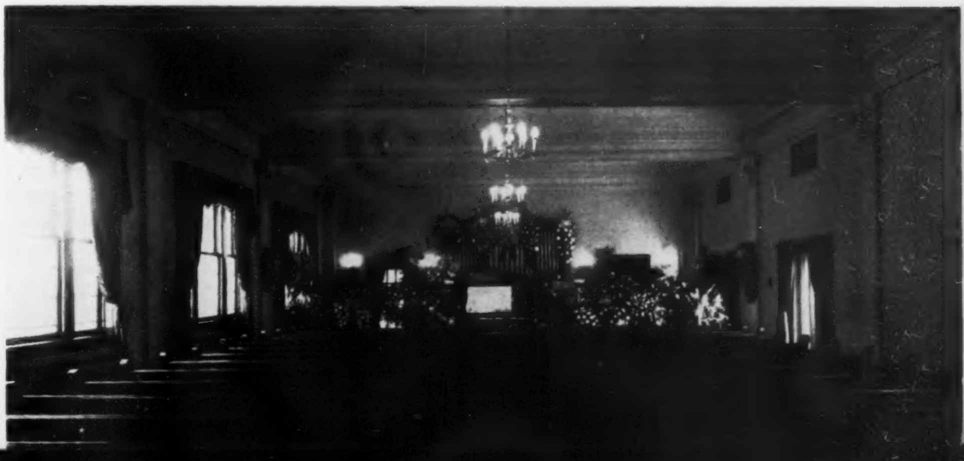
"Realize the air-conditioning installation is essentially a dealer-contractor job," said another, stressing the very important point that one of the best ways for a utility to get a subnormal job on its lines is to infer to the customer that all bids are too high. A tendency of this kind introduces difficulties for all the manufacturers, it was conceded, and it may

BANK—Equipment for cooling only is installed in the Lindell Trust Company, St. Louis; floor area is about 2,500 sq.ft. Connected load, 17 hp.; energy use, 11,400 kw.-hr.

Union Electric Light & Power Company

FUNERAL PARLORS—Chapel, lobby and office and three parlors—about 5,000 sq.ft. of floor space—of Hoffmeister Undertaking Company, St. Louis, are cooled. Connected load, 38 hp.; energy use, 18,000 kw.-hr.

Union Electric Light & Power Company



Consolidated Edison Company of New York, Inc.

DENTAL PARLORS—A central plant, totaling 2.86 hp., and located in a nearby closet, provides air conditioning for this operating room and a reception room of Dr. Wm. Bell, New York City

Duquesne Light Company

BARBER SHOP—The Terminal Barber Shop, together with other public spaces in Pittsburgh's William Penn Hotel, is air conditioned. Total connected load is 135 hp.

lead also to local misunderstandings with trades and crafts.

Extended hour use

"Co-operate with us in experiments to reduce your kw. and increase your kw.-hr.," was another view. One large holding company now is studying storage plans involving ice or cold water, it was said. A Connecticut department store was cited as an example of load factor correction, for in this case annual load factor for air-conditioning equipment was brought up to 23 per cent from 9 per cent, demand decreased from 835 kw. down to 392 kw.

"The greatest co-operation they can give the manufacturer is to arrange national rules and regulations as to sizes of motors permitted on their lines and in reducing the cost of bringing in power lines," was another comment, which will be even more pertinent where residential installations hit their stride.

Watch the councils

A note of warning, not serious but nevertheless persistent, was sounded on the local electrical leagues, air-conditioning associations and councils. Said one informant: "We contact the utility about service characteristics of a job we are working on, and the same day twelve representatives of other equipment, all of them members of the local group, descend upon the customer and he is in a turmoil." That the utility company does not always remember that the local group of contractors and dealers is "just a crowd of salesmen competing on a price basis," was another comment mentioned.

With the industry now facing a shortage of equipment and men, it was indicated to Electrical World that some of the manufacturers would turn down jobs if necessary to control local situations so unsatisfactory as to lead to improper installations, unfair to equipment and customer alike.

For better installations

Toward the achievement of the highly commendable goal of better installations, common to both the manufacturers and the utilities, the manufacturers contributed a number of suggestions.

The point most frequently stressed was that in cases where an installation is contemplated by an organization not competent from an engineering standpoint the utility could well afford to consider reviewing the plans and specifications, as well as the equipment to be used.

On the other hand, complete responsibility for an installation is willingly assumed by the manufacturers consulted in this study. Again, the promotional function of the utility is stressed and most of the manufacturers further ask only for the rendition of a truly unbiased advisory service to the customer. One example of the seriousness with which these companies may take their responsibility to the customer is the present policy in one company to keep distinct and separate its engineers and salesmen.

Financing and servicing

Just as the utility companies reported no need for their financing commercial air-conditioning installations, the manufacturers likewise see no need for utilities to enter this field, except perhaps in an occasional individual local case. All of these manufacturers expressed themselves as of the opinion that all equipment financing was a matter within their province and amply provided for through present governmental and private financial channels.

As for servicing the commercial air-conditioning installation, this the manufacturers say is the responsibility of whomever installs the system. This concentration of responsibility, it is said, is particularly important in the growing number of smaller installations.

A manufacturer has of course a primary interest in the proper and continued servicing of his equipment and is now better prepared to enforce good service through his local representatives.

Tell the customer to "Buy and Install Now," say these manufacturers. Tell him air conditioning is here now and is an investment in better business. Both the manufacturer and the utility will benefit from more emphasis on year-round air conditioning rather than seasonal use.

Light Long-Span Lines Perform Creditably*

Simply Designed and Properly Protected Lines of High-Strength Conductors Prove Ability to Deliver Excellent Service to Farms

By **A. E. SILVER**
Ebasco Services, Incorporated

CONSTRUCTION of farm lines by client companies has continued at a rapid rate. About 3,300 miles were constructed by these companies in 1935 and about 5,000 miles during 1936. Estimated construction for 1937 approximates the 1936 figure, although it may be somewhat less due to the steady thinning out of the prospective customer density in some territories.

Long-span farm lines of light construction have given excellent performance on the whole. In some localities storms, which have done severe damage to conventional type lines and telephone lines, have had little effect on these new long-span lines. Lines in Florida passed through two hurricanes with little or no damage. In Kansas, during a severe storm, a medium-span copper line developed trouble, while a long-span Copperweld line stood up without damage.

A severe sleet storm was recently experienced throughout a wide territory in Texas. Sleet is rare and lines in this territory are designed for light loading. However, very severe conditions were encountered during this storm. The radial thickness of the ice was more than 1 in. in some places, the maximum thickness about 1½ in. In the worst hit sections steel transmission towers were crumpled and few lines of any kind stood up. As would be expected under such conditions, there were numerous breaks of farm line conductors, generally at splices. In numerous places 4,400-lb. guys broke and 5-ft. slugs were pulled up. Ridgepins were bent and ridgepin insulators broken. However, in the entire territory of one large client operating company there were less than one hundred rural line poles broken, out of many thousands in service.

A few cases of miscellaneous difficulties have been reported, such as anchors pulling out of sandy soil, also interruptions where roads have been impassable due to floods. One company reported several failures of 6-in. disk insulators due to bullets.

Cures for vibration

A few conductor breaks in two situations from high-frequency vibration of the smallest diameter solid conductors were mentioned last June. In a third situation similar trouble has been experienced, with both fatigue and chafing in evidence. In one of the first two it is now reported that the trouble has been cleared up by accurate sagging of the conductors. This experience has emphasized the difficulty (impracticability in some cases) of satisfactory sagging by sighting along the spans, and therefore the necessity for using a dynamometer.

Another important factor in controlling vibration effects seems to be the use of properly applied reinforcement at the insulator attachments. This is being studied. In general, the results so far are reassuring in that vibration potentialities, which caused some apprehension at the start, apparently can be successfully dealt with by reasonable attention to sagging and to methods of attachment to supports.

One company which has experienced no breaks reports audible vibration (600 to 800 cycles) on steel wire lines. This is believed to be comparable to the familiar cold weather hum in telephone wires.

Farm transformers behave well

Fairly comprehensive data are at hand for 1936 from fourteen companies on experience embracing something over 10,000 farm type, gap-protected transformers. There were 98 failures in all, or approximately 1 per cent. These failures were divided as follows:

Lightning	24 or 0.24%
Secondary short circuits	35 or 0.34%
Overload	9 or 0.09%
Incorrect connections and application of large overvoltages	4 or 0.04%
Defective transformers (failed when placed in service)	2 or 0.02%
Unknown and miscellaneous	24 or 0.24%

Most of these transformers are of the 6,900- and 7,620-volt class. Seven of the 24 lightning failures were reported as bushing failures.

It is significant that the percentage of failures from lightning is less than one-fourth of the corresponding percentage for conventional transformers of this voltage class, both rural and urban, protected by lightning arresters interconnected with the neutral, as reported by five representative client companies for the year 1935, similar data not yet being available for 1936.

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*Presented at meeting of Transmission and Distribution Committee, E.E.I., Philadelphia, Jan. 22, 1937,

The failures from secondary short circuits were mainly on transformers not equipped with secondary fuses.

At the Edison Electric Institute convention in St. Louis last June the author outlined experience up to that time with the simplified type of farm lines being built with the advice of Ebasco Services, Incorporated, by many of its client operating companies. (See "Electrical World," June 6, 1936, and E.E.I. Bulletin of July, 1936.) The present purpose is to bring down to date the more pertinent items of this operating experience. Herewith is a summary of operating experience, largely during 1936, of fourteen Ebasco client companies with recently constructed farm lines. These include nearly all the major client companies substantially interested in this type of line. The results can be considered as representative for this group.

Secondary protection has been, or is being, adopted by several client companies to minimize this type of failure.

Three of the miscellaneous failures were blown or broken internal primary fuses, without damage to the windings. In general, after some initial troubles, these internal fuses seem to be giving satisfactory performance. One company reports that one transformer shipment, having a faulty design of internal fuse, caused 50 cases of trouble (no damage to transformers), but this was recognized as an error in design and is being corrected by the manufacturer.

Spill gaps effective

The above performance data indicate that spill gaps are giving excellent protection to equipment. Also, experience to date indicates that, where combined with rapid circuit opening and reclosure, interruptions from gap operations have not caused unsatisfactory service.

One operating company decided to add standard primary fuse cutouts on the line side of the spill gaps on two circuits. It is understood that one of these circuits was without automatic reclosure and the other was equipped with reclosing fuses, although the type and degree of coordination are not known. Many blowings of the primary cutouts were experienced with this arrangement.

Another company operated approximately 3,000 farm transformers with original gap settings and without arresters. Even though these circuits for the most part were not equipped with automatic reclosures, reasonably good service was maintained. On a relatively few of these transformers, tapped from three-phase main cross-country lines and serving important loads, this company increased its gap settings and added lightning arresters.

Although the double type of spill gap was included in the initial design of farm transformers, some companies have purchased transformers with the single type of gap. While some trouble has been experienced from birds short-circuiting these single gaps, there has been almost no similar trouble from the double gaps.

One company, in a severe lightning district, cited experience on a single line serving 188 transformers; 68 units, or 40 per cent of these transformers, showed evidence of gap operation, all presumably due to lightning.

In many territories three-shot reclosing fuses, protecting branch lines, are giving satisfactory service in conjunction with spill gaps for transformer protection. Three cases have been reported of all three fuses being blown to cause service outage. A considerable number of reclosing circuit breakers are in use. Particularly those of the latest design are giving good results. One company reports some trouble from some of these breakers when load currents reach a value close to the tripping point. This sets up a chattering condition which injures contacts.

As representing extreme conditions, a company operating in a severe lightning territory reports data on a rural circuit 93 miles in length, controlled by an automatic reclosing breaker set for immediate reclosure on the first trip with 45 seconds and two minutes for the second and third trips respectively. During a portion of the year this circuit chanced to be equipped with oscillographs, installed for other purposes, so that the occurrence of faults and performance of the breaker were recorded with considerable accuracy. During the 1936 season there were:

Total reclosures	272
Lockouts	7

Six of the lockouts were due to trouble on the line and one due to breaker control. During one lightning storm the breaker reclosed fourteen times in 32 minutes without lockout.

Of the operations 119 were accurately analyzed from the oscillograph records, as follows:

Successful first shot	76%
Successful second shot	20%
Successful third shot	None
Lockouts	4%

Regardless of the very encouraging results being obtained with presently available reclosing devices, both circuit breakers and fuses, efforts should be continued further to improve and simplify a single-pole, rapid-reclosing, self-restoring breaker for farm line duty.

Voltage regulation satisfactory

Most companies using farm type transformers without taps report no regulation difficulties so far. Such difficulties as have developed are mainly from high secondary voltage rather than low voltage. Very few boosters, or step regulators, are in service on the systems of these companies, but the number is expected to increase in the future as loads are more fully developed.

Secondary protection of farm type transformers is being found desirable by a number of companies and the transformers are being so equipped rapidly. Ordinary fuses are giving satisfactory protection in most cases. Several type of fuses are being used, including ordinary cartridge fuses treated with weather-resisting preparations. Some trouble has been experienced with secondary fuses of designs having the element under spring tension. These seem to open considerably more often than other types.

Transformers with secondary breakers incorporated in the design are being used in a number of cases and, in general, are giving satisfaction in protecting from secondary overload. A few cases of complaint are made that the breaker setting is too low. This may be due, in part at least, to the sensitivity of this type of breaker to unbalance of load.

No trouble with steel wire

Seven companies report the use of galvanized steel wire of various types. With one or two exceptions the service period has been too short for reporting experience. No trouble, either mechanical or electrical, has been reported, even in those cases of longer experience.

Most companies report nothing unusual in the way of construction methods for the long-span construction. The use of gin trucks is reported in one case and pole-boring machines in another case. Nearly all companies make special effort to utilize the available labor, which is largely unskilled. Opinion on the use of farm labor is about equally divided. Some companies report very unsatisfactory results and others report appreciable savings with reasonable satisfaction. Usually in the latter case, however, the farm labor is employed on regular construction crews under the supervision of competent foremen, rather than on an unsupervised piecework basis, as is sometimes followed, such as in the digging of holes or delivering of poles.

Partly as a matter of expediency, most client companies have been building their lines on public roads, or along highways where practicable. There are two outstanding exceptions to this, one of which is in a territory where the company has no rights to the use of public roads. In most cases where private right-of-way is utilized permanent easements are obtained and legally recorded.

Co-ordination problems encountered in the case of independent telephone lines usually are largely due to such lines having ground return. For the most part a willingness to co-operate to establish the power service has been encountered. Usually each case, as it arises, is worked out on its specific conditions, by informal engineering conference, often on the ground. Practically all companies have encountered good co-operation in any problems with the Bell System companies.

Practically all companies report that no special procedure has been adopted in operating and maintaining farm lines; that is, a similar procedure is used for such lines as for urban and other miscellaneous lines. Most of the lines under discussion are new and maintenance to date has been negligible.

Due to the distances involved, servicing would be expected to be proportionately increased; however, the lack of comment on this point by operating companies would indicate that nothing abnormal has been encountered.

One company reports that the new type of construction decreases radio interference due to the elimination of crossarms, braces, transformer hangers, methods of attaching guys and other features. Another company reports that the amount of tree trimming required for the ridgepin type of construction is considerably less than that for standard crossarm construction.

Experience to date is reassuring as to the safety of workmen, customers and public, as related to the common multigrounded circuit neutral and to the single-bushing transformers with grounded cases.

Protected exposed lines give satisfactory service

Experience to date has strengthened our conviction that simply designed lines, embodying high-strength conductors, long spans, medium insulation, common multi-grounded neutral, spill-gap protection and rapid fault disconnection and reclosure can be depended on to give excellent service to the farms. On those systems readily adaptable to this type of extension, and where the greater effort has been directed to working out the needed co-ordination, the results are especially reassuring.

The combination of spill gaps to protect equipment insulation, with rapid fault disconnection and reclosure to effect service continuity, perhaps more than any other feature, has been on trial. With continued experience and engineering attention, steady progress may be expected in further improving the co-ordination and functioning of these features. The results bear out that excellent protection is afforded to equipment, and indicate that satisfactory service can be maintained, even with extensively exposed lines in severe lightning areas.

Highway Lighting Raises Property Values

Now we come to consideration of the effect of highway and street lighting on frontage values and the resultant interest to realtors.

Let us discuss briefly the subdivision development. Perhaps prime consideration is given to effective street lighting, preferably ornamental in character — and why? Because experience has proved that people buy more readily where such service is available and pay a higher price per front foot than they would pay otherwise. Of course, cost of installation in the case of the better class of lighting systems is included in the property price.

The records show that invariably in well-lighted cities, towns and villages the value of property is higher than in comparable places poorly lighted. Now, then, it is true that much rural property is stagnant, not because it is inaccessible, but rather because it is not attractive to the builder of a home or commercial institution because of the hazards of reaching it after dark. By safeguarding the motorist at night by installing proper lighting on the highway, his purpose is served and, at the same time, we may expect gradual upward movement in real estate values and activity.

Building along such highways will be accelerated as well as on property located on lateral highways in close proximity to the main lighted highway.

JOHN W. GORBY,
Field Secretary Chicago Real Estate Board,
to Illinois Association of Real Estate Boards.

Editorials

HOWARD EHRLICH . EDITOR

Insulation Test Needed

A PROBLEM that is receiving considerable thought today is how to determine the efficiency of insulation that has been in service for some time and the probable additional life of that insulation. Technique has been developed for finding out how much voltage any given insulation will stand, but, unfortunately, any scheme that punctures the insulation wall spoils the equipment involved as effectively as if it failed in service.

One particular problem still awaiting solution is that of the insulation in generator windings. The best of it deteriorates with age, some of the more modern varieties less than those of an earlier decade, although there are machines that started operating early in the century and still are functioning with the original insulation. Failures, however, are occurring. They come without warning and with embarrassment to system operation. This criticism is no reflection on the quality of the insulating material or its service life. These failures, however, must be anticipated. The problem is to find a test that will show how much more service may be expected before failure should be expected, that will neither cause breakdown nor accelerate it, no matter how definitely it seems to fix a future date for probable failure. Here is a challenge to the research mind to develop a technique that will disclose incipient weakness without aggravating it.

Especially is it desirable to perfect a turn-to-turn test as well as a turn-to-ground test because many engineers suspect that the former is more important. That will prove a hard nut to crack because the two paths of high-voltage insulation in series are shunted by a conductive path of very low resistance. Foil placed between turns when the coils are wound would simplify this problem, but it would do so with the risk of reducing the problem to a turn-to-ground test as well as of altering the original design proportions.

What is wanted is some way of finding out how much longer a machine can safely be run and whether it will be more economical then to rewind it than to repair damaged coils, taking into consideration the fact that current methods of lifting and restoring coils adjacent to replaced ones are conducive to early repetition of failure.

Industrial Electric Truck Improvements

OBSERVATION of recent developments in industrial electric truck design indicates that this useful material-handling tool has literally "gone cubist" in its adaptability to space conditions. For many years these concentrated units performed remarkable service in horizontal transport. Next was added lift-truck operation. From ordinary lifts designers went on to provide for handling heavier and heavier loads at an angle, and today weights of several tons extending several feet outboard from the truck frame can be swiftly and safely handled by properly made units. Heavier storage cells meet power requirements, and lately the use of aluminum alloys has come into play to cut down truck weight without loss of strength, and so increase the "runnage" and lifting service per charge and per diem.

Industrial truck and accessory equipment makers deserve to be congratulated upon the improvement in their products, so much of which coincided with depressed business conditions. It is to be hoped that utility power salesmen will still more generally recognize the value of the truck-charging load and enter into more effective co-operation in market development. More complete service data are desirable in many installations, which means more instrumentation and closer economic control of service. These large modern units justify a more scientific approach to performance analysis.

When Does Output Overtake Capacity?

THERE still is lively speculation as to future developments in the race between the industry's generating capacity in kilowatts and the output curve. Preliminary data just released show that in 1936 the industry generated 3,119 kw.-hr. per kilowatt of capacity. How does this figure compare with the previous record? Just what does it tell us about developments which may take place in 1937?

First of all, in 1929 the industry established its highest record of 3,184 kw.-hr. per kilowatt of capacity and there followed the largest construction program in utility history. By 1932 output had dropped 28 per cent to 2,292 kw.-hr. per kilowatt and to approximately the U. S. Census figure of 2,240 kw.-hr. for 1912.

But it is the current rate of recovery that is most striking. For while the output per kilowatt increased only about 2 per cent in 1933, in 1934 it was up 8 per cent, in 1935 up 9 per cent and in 1936 up 13 per cent.

Nevertheless the gap between output and capacity is being rapidly closed. In 1935 the figures show an actual decline in central station prime mover capacity; in 1936 the utilities increased capacity by 2 per cent. In 1937 utilities' construction plans for steam-generating facilities are $4\frac{1}{2}$ times that of 1936. Low-priced money is indeed an important factor in the construction budget, but the facts do pose the question as to whether an industry output of approximately 3,150 kw.-hr. per kilowatt has become a reliable index as a measure of future generating capacity.

An answer to the question is of course precluded by the paucity of data. Furthermore, it is well recognized that there are a score of engineering, financial and economic variables influencing the ever-changing ratio of kilowatt-hours per kilowatt.

In passing, however, one of the factors which may subsequently be isolated from the others and evaluated for the industry would be the extent to which the more intelligent load-building programs have increased this ratio.

Air Conditioning Discloses Need for Planning

THE power company engineer will be interested in the commercial air conditioning survey, as presented in this issue, because of the load that is being added and its character. Moreover, well-informed observers confidently predict that the load added this year by commercial air conditioning will be two to three times that added last year.

Individually the loads are of small magnitude, for hundreds of stores, restaurants, taprooms and shops are air conditioned by 10- to 25-hp. units. Even in the aggregate these loads would not be troublesome except for their characteristic tendency to congregate in the downtown section and in the heart of the suburban business center. This characteristic is in fact so pronounced that there are a number of companies which already look with disfavor upon additional commercial air-conditioning loads. The reason for this, of course, is that revenues are not considered to be commensurate with the cost of additional service facilities.

If the commercial rate schedules have been properly designed, then the difficulty could not be in the revenues, but must be in the cost of facilities. If this is the case, the need is urgent for closer co-operation between sales and engineering.

The increased revenue so necessary today to operating companies comes from a modern technique of load building, which usually includes a well-rounded plan for the development of markets. Armed with this additional information from its sales department, the engineering department could plan system improvements on a broader and more economical basis. Then there would be fewer companies facing new loads such as commercial air conditioning, carrying new and much-needed revenue, but loads which are not compensatory because the cost of providing capacity now is often so much more than it would have been under more foresighted system planning.

Pole Inspection Becomes an Engineering Job

CROWBAR testing methods for determining condition of standing poles are on the way out. Comes now the engineer with calipers and gages, tables and graphs, announcing that measurement and calculation are to take the place of personal judgment based on a few jabs with a crowbar.

With the usual inspection methods of long and honorable history, the number of poles replaced after a testing foray was often more dependent on the past experience of the inspector and the type of man he was than on the actual conditions of the poles he checked. If the inspector were an ex-lineman, a climber who knew the feeling of danger from a shaky pole under him, he would be more than a little inclined to play safe and order a new pole installed if by chance the first jab of his bar found a weak spot. And a pole that one inspector would consider to be perfectly safe might be unhesitatingly condemned by another who was by nature ultra-careful.

Some years ago it was realized by the Commonwealth Edison Company that personal opinion was a poor base for decision on whether or not a pole was strong enough to remain in the line. Opinions differed, as did the men who gave them. After all, the strength of a pole is a matter of the sound wood there is *actually* in it, not of how much sound wood even the most experienced inspector *thinks* there is in it. And the way to find out how much sound wood there is in a pole is to measure it.

A technique for doing this measuring job is described in this issue. The method discloses with fair accuracy the strength of the pole at the ground line, which is the line of greatest decay and as well the place of greatest stress. No claims are made that this test method gives a complete picture of the pole condition; it would not, for instance, discover a weak point farther up the pole. But it does show the condition at the usual danger point, and that is about as good as can be done for normal operation.

President's Views on Take-over Value

By CARTER FIELD

This noted journalist gives his personal comments and interpretations on current happenings affecting the electrical industry. His background and his location at Washington make his thoughts informative and interesting even though all may not agree with him.

WHAT return should investors in the electric industry be allowed on their money? What is a fair charge for management? What allowance, if any, should be made for what might be termed creative foresight, in figuring the total capital on which return should be computed?

As if these questions, which despite the surface maneuvers go right to the heart of the whole T.V.A. and government versus private ownership problem in the electric industry, were not tough enough, they are just the beginning. For then comes: What sort of compromise will finally be reached to determine national government policy in dealing with the electric industry, as between the various answers to these questions.

At one extreme we find such answers as given a month ago in ELECTRICAL WORLD by Representative John E. Rankin. He is not interested in fixing rates. He is interested in having the government take the private utilities over, at second-hand clothes valuation, with no allowance for creative foresight, franchises, previous risks, or anything else.

At the other extreme we have what might be termed the Wall Street viewpoint. This regards every going, successful business as part of a whole picture of investment, a picture in which total losses have been frequent, and partial losses almost the rule, and hence something which must not only pay a fair return on the investment, but also a fat profit to make up for other losses.

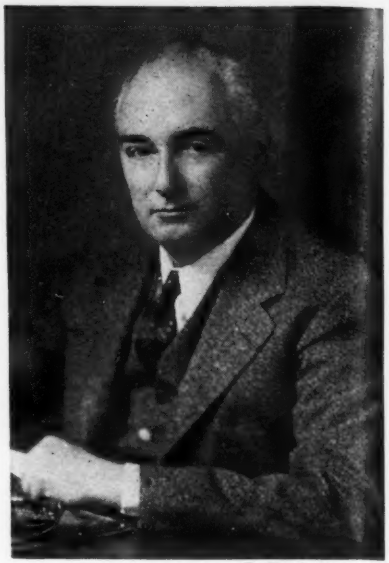
President Roosevelt is naturally the person whose views are of the most importance. Unfortunately, he has never answered the questions publicly. He has discussed them privately on several occasions, but those with whom he has talked have come away with rather wide variations as to what his real thought was, though in each case the caller was very sure he had obtained an accurate impression of the President's views. Moreover, if the President ever discussed all three questions—the rate of return, allowance for creative foresight and cost of management—in the same interview, it has not been so stated by the callers.

But putting together the bits of the jigsaw puzzle as well as we can, the picture becomes something like this:

The President believes in very low interest rates. With respect to public utilities which are granted monopolies, he does not admit that there is any element of risk. On the contrary, his notion is that the government is virtually—as the situation has developed—guaranteeing the success of the investment. Hence the rate of return might be figured merely by the cost of long-term money in cases where no risk is involved. Projecting this still further, the rate might be determined by the rate the government has to pay on long-term bonds, with adjustment made for the tax-exempt provisions of government bonds. Which last Mr. Roosevelt would like to eliminate, by the way.

As to allowance for creative foresight, the position of the President is much more nebulous. He has repeatedly indicated, however, that he would allow *something* for this. He was quoted by one caller some time ago as thinking about 5 per cent would be about right. He is alleged to have told a utility man that anything more than 10 per cent would be taking undue advantage of the public.

There is no money-back-on-demand guarantee on this statement, but presumably if the government were taking over a privately owned electric company, or were fixing rates it could charge, and the investment should be agreed upon at 100 million dollars, Mr. Roosevelt would approve fixing the capitalization at 105 millions, would not be outraged at fixing it at 110 millions, but would fight anything above that figure.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When it comes to management costs, the President's views are pretty well known to friends interested not only in the electric business but in other lines. He has a very strong feeling against large salaries in any business. Certainly anything above $50,000 a year he would not tolerate, in any computation fixing rates to be paid by the public. That is the *top*.

And this $50,000 a year maximum, incidentally, is only, in his judgment, justified by very few executives now adorning the electric field. So much so that the burden of proof to show that such a salary was justified in computing electric rates would be on the utility paying it.

All of which attempt to assemble the President's views relates exclusively to operating electric companies. It has nothing to do with holding companies. His views about them have been rather openly expressed on many occasions. But as related to the fixing of rates, it might be put thus—that the burden of proof that any charge for management or services is reasonable is absolutely on the utility.

On top of this it might be added that while the President's ideal for America would continue the profit system (with very small profits) and private ownership consequently in most lines of business, he certainly leans just a little toward public ownership in the electric field.

Letters TO THE EDITOR

Rocking Reduces Belt Pull

To the Editor of Electrical World:

In the Electrical World for November 21, page 74, there appears an article "Rocking Motor Does Just the Right Thing," by W. F. Schaphorst, in which it is stated that "the motor automatically does the *right thing*, all the time. Regardless of whether the belt is bottom or top pull, and regardless of the direction of the belts . . . "

If the "right thing" is interpreted to mean that the belt shall become tighter as the motor torque increases, then the statement is not true as the following analyses will show. Thus, using Mr. Schaphorst's symbols, let a 1-hp. motor at 1,750 r.p.m. and the following dimensions be assumed:

1 hp. Torque = 36 in.-lb.
W = motor weight = 80 lb.
L = 6 in.
j = elevation of motor shaft center above fulcrum = 8 + in.
Pulley diameter = 8 in.
H = elevation of upper side of belt above fulcrum = 12 in.
h = elevation of lower side of belt above fulcrum = 4 in.
B = belt tension on lower side.
T = belt tension on upper side.

$$B - T = \text{useful belt tension} = \frac{36}{4} \text{ or } 9 \text{ lb.}$$

When the motor is idle and is in the position shown in Fig. 2 of the article (for the purpose of this analysis it is sufficient to asume that the belt is short enough and tight enough so that the motor position will not change with load) the following analysis applies:

Moment of weight of idle motor, about the pivot = $WL = 80 \times 6$ or 480 in.-lb.

$$T + B = \frac{WL}{j} = \frac{480}{8} \text{ or } 60 \text{ lb.}$$

$T - B = 30$ lb.

When loaded, rotation counter-clockwise, the conditions are:

$WL = 80 \times 6 = 480$ in.-lb.
$TH + BL = 480$.
$T - B = 9$ (Note that signs of T and B will interchange with rotation) $(9 + B)\,12 + 4\,B = 480$.

$$B = \frac{372}{16} \text{ or } 23.25 \text{ lb.}$$

$T = 32.25$ lb.
$T + B = 55.5$ lb.

Thus the total belt pull has been reduced.

The same result may be shown in another way also, by taking the force due to the torque, referred to the direction of the belt as equal to

$$\frac{\text{motor torque}}{j} = \frac{36}{8} \text{ or } 4.5 \text{ lb.}$$

Then since this is opposite in direction to the effect of motor weight, $T + B = 60 - 4.5$ or 55.5 lb.

Similarly, it may be shown that when the rotation is clockwise the result will be:

$T + B = 64.5$ lb.
$T = 27.75$ lb.
$B = 36.75$ lb.

Again, if the belt is vertical, with motor idle, the pull in each side of the belt will be 40 lb.

With rotation counter-clockwise:

$B + T = 74$ lb.
$T = 41.5$ lb.
$B = 32.5$ lb.

With rotation clockwise, the figures are:

$B + T = 86$ lb.
$T = 38.5$ lb.
$B = 47.5$ lb.

It is thus clear that the statements in the article need some revision. A rather extensive treatment of this subject may be found in a paper "The Pivoted-Motor Drive," by Robert R. Tatnall, in "*Mechanical Engineering*" for May, 1935.

A. F. Puchstein and T. C. Lloyd.
(Robbins & Myers, Inc.)
Springfield, Ohio.

●

Suggests Use of Ground Wire as Circuit Wire

To the Editor of Electrical World:

Winter always focuses attention on transmission lines; worried frowns watch sleet storms; will the "glaze" bring the lines down; wherefore, I submit a suggestion which to my knowledge has not been tried heretofore.

Many lines are already equipped with ground lines; many more will be. In the winter time, however, the need for ground wires is lessened; at the same time possibilities of heavy sheathings of ice arise.

Insulating the ground wire for full line voltage, repositioning said wire with respect to the towers and providing suitable switches, would accomplish the following:

1. At the end of the period when the ground line is more desirable, switches on line towers and poles could be opened, thus providing a surplus wire.
2. A low-voltage high-amperage circuit could be established using the surplus wire and a power wire for the path, thus melting all ice on these two wires; then by switching a phase into the surplus wire and switching the low-voltage high-amperage circuit into the remaining two wires a three-phase or other phase system could be cleared of all ice coatings with no interruptions on the line and a minimum of power loss.

The surplus wire could be used temporarily should it become necessary to isolate any of the normal transmission wires.

There must be cases where this practice would be justified.

Beauvais B. Fox, Jr.,
Port Jervis, N. Y.

[Many reasons are obvious why the proposal could not be adopted generally, but nevertheless some one somewhere may already have found the idea or a similar one feasible, possibly on rural lines.—Editors.]

●

Gas Tax for Highway Seeing

To the Editor of Electrical World:

There seems to be considerable interest by municipal men in advocating the use of a portion of the revenue derived from gasoline tax in the Commonwealth of Massachusetts for the purpose of installing and maintaining adequate street lighting systems upon the state-controlled highways.

At the present time many municipalities expend annually a considerable amount of money for lighting the state roads within the bounds of their individual municipality, but due to the large mileage they cannot afford to light them adequately in a manner properly to protect the users.

In the city of Beverly 10 per cent of our total street lighting appropriation is expended for lighting state highways that are within the bounds of our city.

The state roads in Massachusetts are constructed and maintained from the revenue derived from the gasoline tax, and I ask, is it not fair to assume it is just and proper to request that funds be taken from the revenue of such tax and applied to the installation and maintenance of adequate street lighting for them in order that the motorist as well as the pedestrian may use them at night with a greater degree of safety. The greater percentage of the revenue received from the gasoline tax comes out of the motorists' pockets, so why shouldn't they insist that a part of it be used for more adequately lighting the highways? When night accidents occur on state highways very little is ever said about inadequacy of lighting, even when it might have been the cause of the accident. The new sodium and mercury-vapor and other highway units have been perfected for such lighting and no serious handicap exists to retard a rapid expansion of more and better street lighting systems for our state highways. This most valuable addition to our highways would be the answer to "injury and death" in the dark, and would add to the pleasure of night driving.

Think this proposition over and ask why any city or town that has state highways within its boundaries should be called upon to expend money for lighting them so the lives of the users may be better protected.

W. H. Greenlaw,
City Electrician, Beverly, Mass.

News OF THE WEEK

Federal Board Urged to Dispose of Surplus Power of Bonneville

Bill introduced by Representative Smith would provide for Columbia River Administrator — Marketing problem confined to provisional basis subject to change when permanent set-up is devised

Conclusions reached by the Ickes power policy committee in regard to the disposition of surplus power from the Bonneville project on the Columbia River were revealed last week by the introduction of a bill avowedly intended to give effect to the committee's recommendations. The bill was introduced by Representative Martin L. Smith of Washington on the day following a White House conference at which the committee's report was discussed before the Congressional delegation representing the states affected. Congress received the bill last Wednesday.

The new solution to the Bonneville marketing problem is set up on a provisional basis, subject to change when a more permanent set-up is devised for Bonneville and other projects in the Columbia River basin. It proposes that the completed project shall be operated, maintained and improved by a Columbia River Administrator to be appointed by the Secretary of the Interior at a salary of $10,000 per year.

Three-man board

This administrator shall be advised by a three-man board composed of representatives of the War Department, the Federal Power Commission and the Department of the Interior. He shall have full authority to install additional generating facilities, operate the plant, to contract for the sale and interchange of power and to build, buy or acquire by condemnation proceedings all necessary distribution facilities. Operation of the navigation locks, however, remains a function of the Corps of Engineers under the Secretary of War.

In all other respects the new bill follows the pattern set last session, when a number of measures were introduced, but failed of passage. Continued is the statutory preference for public and co-operative distributors in the allocation of power, with 50 per cent of the firm power reserved until Jan. 1, 1939, to permit the formation of co-operatives and power districts.

Power contracts

Power contracts are to extend for not more than twenty years, including any renewal period, and are to carry provisions for rate revision at intervals of not over five years. In the case of contracts with private purchasers, they must also contain a provision for cancellation upon five years notice in the event that the energy so conveyed is needed for public or co-operative distribution.

The administrator is directed to prepare rate schedules and submit them to the Federal Power Commission for its approval. "Such rate schedules shall be fixed with a view to encouraging the widest possible use of electric energy, having regard to the recovery, upon the basis of the application of such rate schedules to the capacity of the electric facilities of Bonneville project, of the cost of producing and transmitting such electric energy, including the amortization of the capital investment over a reasonable period of years. In computing the cost . . . there may be allocated to the cost of electric facilities not simply the cost of such facilities, but also such a share of the cost of other facilities . . . as the power development may fairly bear. . . . The rate schedules may provide for uniform rates or rates uniform throughout prescribed transmission areas. . . .

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N.E.M.A. Exposition Plan Being Studied

A N.E.M.A.-conducted exposition plan is being given careful consideration by the exhibitions policy committee, the board of governors and the membership of N.E.M.A. as a part of the N.E.M.A. Business Development Program.

An analysis of the problem has been made by the exhibitions policy committee and given consideration by the board of governors during the N.E.M.A. Mid-Winter Conference and was presented to the Policies Division by Clarence L. Collens, chairman of the committee, in order to secure the views and suggestions of the members.

The committee has been requested to carry its analysis of the problem further and to prepare a more detailed plan with definite recommendations as to scope, policies, necessary organization and procedures for a N.E.M.A.-conducted exposition or expositions, in case such a program should be decided upon.

•

Utility Makes $5,000,000 Offer to Sell Properties

Following a conference with the Wisconsin Public Service Commission, the Superior Water, Light & Power Company offered to sell its water, gas and electric properties as well as those of the Associated Northern Power Company to the city of

Superior for approximately $5,100,000. One of the conditions of the sale is that a reduction of $26,000 a year in the gross wholesale rates paid the Minnesota Power & Light Company for electricity contracted for by the two companies is to be secured.

•

Utility Plans Fund to Improve Service

Expenditures of $300,000 to improve power station facilities and electricity distribution in the Virginia Electric & Power Company's Richmond division will be made during this year, Jack G. Holtzclaw, president, has announced. He said this would be part of a $2,874,100 outlay for the electric department throughout the company's entire system.

Of the $2,874,100 to be spent in Virginia Electric & Power Company's electric department this year Norfolk will get approximately $500,000 for improved power service similar to that promised for Richmond and about $85,000 for work on the company's gas plant there.

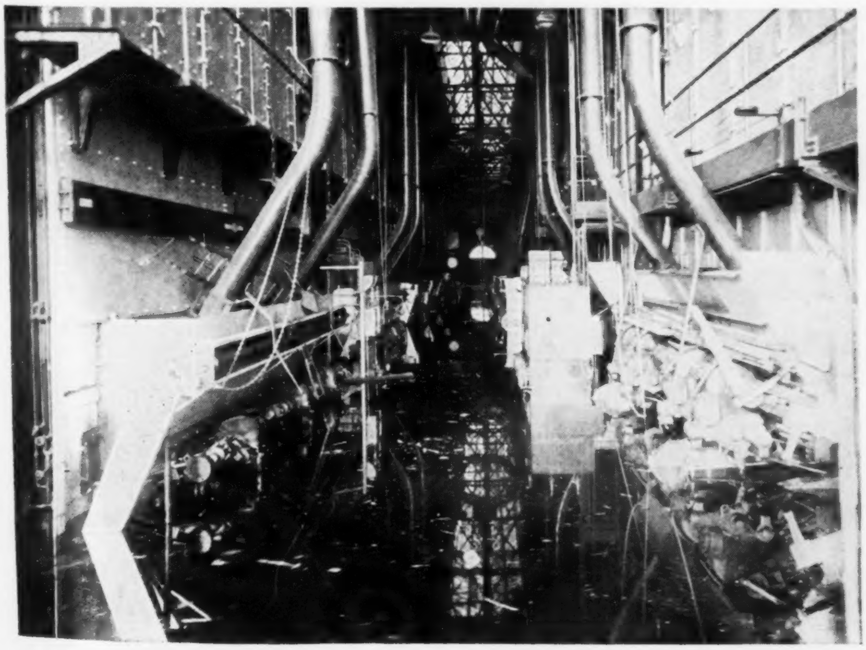
Mr. Holtzclaw said an estimated $850,000 will be expended on extensions connecting new customers throughout the system, which embraces Tidewater, Virginia and eastern North Carolina. About $350,000 was allocated to construction of new rural power lines.

Electric Service Being Restored in Louisville After Peak Flood

Louisville Gas & Electric supplying current through interconnections with Cincinnati and with Indiana and Kentucky utilities — Rehabilitation work putting generating plants back into operation

Rehabilitation in Louisville and surrounding territory is progressing rapidly after the recent flood. Utility service is moving back to normal as power stations are being put into operation. Louisville Gas & Electric Company carried a peak load of more than 40,000 kw. last week through interconnection with Cincinnati and with Indiana and Kentucky utilities, according to T. B. Wilson, president. The normal load at this time is about 70,000 kw. It is expected that it will soon be possible to put into operation a 25,000-kw. unit. All substations, except two used exclusively for railway service, are in service.

The Canal Street generating station is being put back into service, with resumption of operation at Waterside expected some time in the near future. The hydro plant is expected to be out for three to five months. The underground network in the business section of Louisville is being provided with full service. Radial underground cable (4,000 volts) which was giving about 70 per cent service is now giving about complete service. The overhead distribution system, except in those districts where greatest property damage resulted from the flood, can now handle practically all customers whose equipment and wiring facilities are ready for service.



FLOOD IN LOUISVILLE—The boiler room in the Waterside station of Louisville Gas & Electric Company shows water 44 inches over the floor at the crest of the flood. Rehabilitation progressed rapidly to restore service as the water receded

Large force at work

Engaged in the work of rehabilitation of gas and electrical facilities are from 600 to 800 temporary men in addition to the 1,200 regular employees of the company. About 175 vehicles are being used. Expert labor, line trucks and equipment have been supplied from other companies in the Standard Gas & Electric system.

The Waterside steam station, which was constructed to withstand water about two feet higher than any flood in the history of the city, went out of service at 11:40 p.m. January 24. The Canal Street station, an auxiliary generating plant, which is located on still higher ground, went out of service at 8:15 p.m. the same night. A rural line of the company was tied to one of the Kentucky Utilities Company early the next morning, after an emergency connection had been made southeast of Shelbyville. A 10,000-kw. transformer of the Kentucky Utilities Company was moved by rail from Shelbyville to a point on the Dix River dam power line near Lyndon. Current was turned into the Highland substation and service extended to residential sections and suburban communities.

Restoring service

C. D. Laidlaw, Jr., commercial service department, General Electric Company, reports that the flood in Louisville reached a peak of 57.1 feet on January 27, as against a flood stage of 28 feet. The previous peak was 47.3 feet in 1884. The flood area comprised about three-quarters of the city.

The Marine Electric Company, G.-E. motor and control agent in Louisville, has made arrangements through one of the plants it regularly serves to use twelve large ovens for drying out apparatus, Mr. Laidlaw said. Every effort is being made to restore electrical equipment to service.

Louisville Gas & Electric is advising its customers on means of restoring equipment to service and states that its men will check the work. The city electrical department and electrical contractors are co-operating in the work.

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Alabama Power Sells System to Tuscumbia

Sale of the Alabama Power Company's distribution system at Tuscumbia, Ala., to the city has been announced by Mayor R. H. Beasley. The sale price according to Beasley, was $106,500 and the transfer will be effective April 1. The city is expected to use T.V.A. power from Wilson Dam.

The sale ends a long series of negotiations following the entry of the T.V.A. into the power business. Originally the Alabama Power Company offered to sell the Tuscumbia system for $120,000. The purchase includes all utility properties within the city limits plus an extension line into Sheffield, where the Tuscumbia system will hook onto a T.V.A. line.

It was announced that the town of Muscle Shoals has received an $18,000 loan from the P.W.A. for construction of a municipal power system at a cost of approximately $32,000. In addition there is a $14,000 grant, of which $1,250 has been received.

•

Seeks to Acquire New Units

Laclede Power & Light Company of St. Louis, Mo., a registered holding company, has filed application for approval under the Holding Company Act for the acquisition by it of a leasehold interest in the electric generating properties at Granite City, Ill. These properties are now held by George B. Evans as trustee of St. Louis Gas & Coke Corporation, a Delaware corporation. Hearing will be held on March 4.

•

E.H.F.A. Contract Closed

Announcement has been made that E.H.F.A. has closed a contract with the city of Dyersburg, Tenn., which owns and operates the local municipal utility.

Connecticut Electric Utilities Announce Construction Programs

Five companies to spend in excess of $15,000,000 for expansion of facilities and additions to plants — Major projects include installation of steam turbo-generators, boilers and substations

Connecticut power companies plan expenditures this year for improvements, distribution expansion and plant additions to cost in excess of $15,000,000. The Connecticut Light & Power Company leads with a planned construction budget of $5,027,099, which will be used as follows: Installation of 25,000-kw. steam turbo-generator at Montville, $1,578,000; transmission improvements, $628,300; substation improvements, $422,040; electric distribution, $419,500; office and service building, $261,850.

Connecticut Power Company plans to spend $1,304,786. Major projects are two 66,000 volt substations, one at Middletown to cost $300,000 and the other at Stamford to cost $250,000. The Middletown project replaces a similar station at Cromwell, which will be abandoned due to flood conditions in March, 1936.

Contract awarded

Hartford Electric Light Company will spend $3,900,000, all but $400,000 of which will be required for the South Meadow power plant extension, a 40,000-kw. condensing turbine-generator and a boiler with a capacity of 400,000 lb. of steam per hour. Contract is awarded and project will be completed in 1938.

Derby Gas & Electric Corporation has plans to use $120,000 for the increased distribution of gas and electric current and $140,000 for power plant extension.

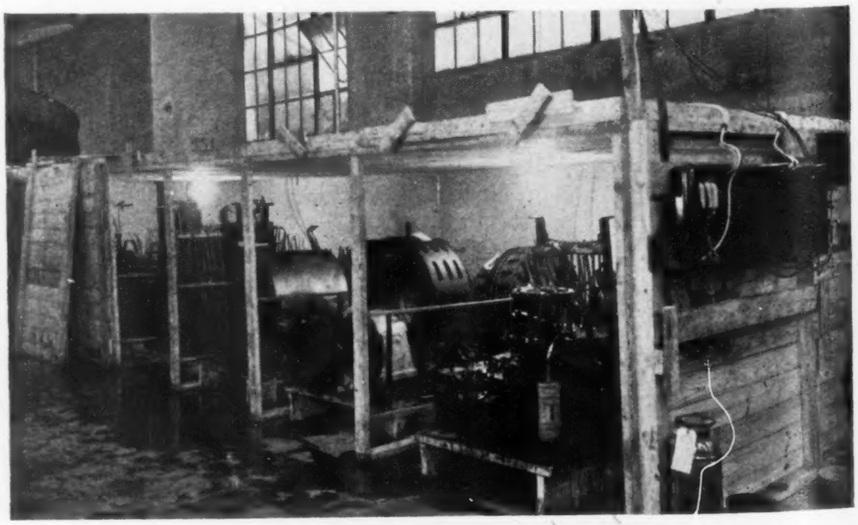
Litchfield Electric Light & Power Company will use $61,620, of which $8,000 will go for replacements and the balance for extensions and additions to facilities in the Ridgefield, Litchfield and Harwinton districts. Much of this is in rural communities.

United Illuminating Company, New Haven, has not announced plans.

•

Bandoli Sees Expanding Market for Refrigerators

Discussing saturation in the electric refrigeration industry before public utility executives and electric appliance dealers and distributors meeting in New Orleans, Marvin S. Bandoli, recently appointed domestic sales manager of the Kelvinator division of the Nash-Kelvinator Corporation, pointed out that only 9,000,000 of the 21,887,000 homes wired for electricity are actually equipped with electric refrigeration.



AFTER THE FLOOD—One of four improvised ovens built by General Electric Company service shop in Cincinnati to dry out water-soaked electric apparatus. Temperature is maintained at about 110 deg. C. by eighty 500-watt strip heaters and six 3.8-kw. ribbon heaters in the oven 30 ft. long, 66 in. high and 10 ft. deep

Utility Disputes T.V.A. Claims in Analysis of Federal Agency

Commonwealth & Southern says annual report is inconsistent, unfair and exaggerated — Willkie asserts attempts are being made to impress Congress with power program on Tennessee

Electric energy can be generated in modern steam plants in the Tennessee Valley at a cost per unit of only about two-thirds of what it will cost to produce the same energy by water power developed today on the Tennessee River, according to Wendell L. Willkie, president of Commonwealth & Southern Corporation.

In a searching analysis of the activities and programs of the Tennessee Valley Authority Mr. Willkie points out that the Tennessee River is only moderately suited to hydro-electric development. The surrounding country, however, he says, is "one of our great coal-producing sections." He also states that the production of electric energy by steam employs approximately ten times as many people per unit as does the generation of electric energy by water power.

Discusses T.V.A. report

Charges of inconsistency, exaggeration and unfairness were leveled at the recently issued annual report of T.V.A. in the 60-page discussion of the report. "This annual report of the T.V.A. is written with rare literary charm and attractiveness," Mr. Willkie said. "It, however, in our judgment creates a glorification of the work of the authority which is not maintained on analysis. The authority through the report seeks to impress the Congress with the magnificence of its accomplishments, to the end that there may be no let-up in the flow of public funds, which, for over 3½ years, has flowed into the hands of its directors to expend with almost uncontrolled discretion."

The current low values placed on senior securities of the Southern utilities of the system as contrasted with those obtaining for like securities of the Northern units are attributed directly to the threat of T.V.A. competition.

It was asserted by Mr. Willkie that when T.V.A. was created in May, 1933, it had placed under its control the Muscle Shoals development, which represented an investment of $125,000,000 by the federal government. Since then it has received $150,900,000 additional of the taxpayers' money. Consummation of the already planned program, according to recent estimates of T.V.A. directors, will eventually cost the taxpayers $500,000,000, Mr. Willkie said.

Mr. Willkie pointed out that the T.V.A. report attempts frequently to create the impression that the cities and co-operatives purchasing T.V.A. power are unusually fortunate on the profit side of the ledger. "The fact is not mentioned," he said, "which is revealed by a study of the report, that this profit would more than vanish if the municipalities and co-operatives allowed adequate capital charges and the T.V.A. did not absorb for them in its expenditures a great many charges which operating utility companies and municipalities operating on their own responsibility must pay."

Mr. Willkie also stated that "the T.V.A. is a sectional experiment which is costing the federal taxpayers in all parts of the country hundreds of millions of dollars."

•

Urge Federal Board to Control Utilities

Creation of an Interstate Power Commission, armed with the powers needed for it to perform the functions in the power field that the Interstate Commerce Commission has in the commerce world, is being urged by Representative Gardner R. Withrow, Wisconsin, who is claiming the backing of the 171 members of the loosely formed "power group" in the lower House.

Representative Withrow says that perhaps his proposal will take the form of increasing the scope of the Federal Power Commission, and added:

"There is no criticism intended in the statement that the state power commission bodies have failed utterly to grapple successfully with the involved power problem. The problem is just too big for them, that is all. It overlaps their jurisdiction, and it legally and logically falls within the purview of the federal government.

"The same condition prevailed with the railroads until the I.C.C. took charge. Since then conditions have bettered tremendously both for the carriers and the public. The power snarl is pretty much the same in many respects, and it seems to me that we can learn a wholesome lesson from the experience of the railroads in dealing with this problem."

•

Cooke Holds Rates to R.E.A. Too High

Morris L. Cooke, retiring R.E.A. administrator, declared, on the eve of his departure for a six months' vacation, that the Rural Electrification Administration intends to build many more generating plants unless it receives satisfactory wholesale rates on electric power from private companies.

It was pointed out by Mr. Cooke that about 95 per cent of the rates quoted by private utilities for serving R.E.A. projects are too high. He expressed the opinion that a figure of about 1 cent per kilowatt-hour would be satisfactory. Most rates now being quoted are around 1½ cents.

Conferences on the possibilities for new electrical farm implements are being held by representatives of the International Harvester Corporation with R.E.A. It was stated by Mr. Cooke that along with the Department of Agriculture the R.E.A. was trying to interest farm equipment manufacturers in new electrical machinery. Other manufacturers have discussed the matter with the R.E.A.

•

Seeks Permit for Power Plan

Application has been filed with the Federal Power Commission by Mount Vernon, Inc., Marianna, Fla., for a preliminary permit for the construction of a development on the Chipola River in Calhoun County, Florida. The project proposes the construction of a dam approximately 25 ft. high on the Chipola River and a power plant with capacity of approximately 20,000 hp. The energy is to be used to supply the needs of the new city of Mount Vernon, neighboring towns and adjoining farm homesteads.

Idaho Power Plans to Complete Hydro-Electric Plant Next Fall

Will spend $2,400,000 on new construction at Upper Salmon Falls project, which will have 18,000 kw. capacity — Expansion of facilities will be made to meet increased demand — Contracts to sell power

A capital investment of $3,040,000 will be made this year by the Idaho Power Company for expansion and addition to facilities, according to K. M. Robinson, president and general manager.

Plans for the completion by September 15, next, of a hydro-electric plant at Upper Salmon Falls in Snake River in the Hagerman Valley near Owsley bridge were also announced.

"Increased demand for electric service has made practical the expansion of our facilities at this time," he said. "Due to the increased mining operations in Utah our company has been fortunate to secure a contract with the Utah Power & Light Company for the sale of the surplus power generated at this plant during the next two or three years before the full capacity of the plant will be needed in the Idaho Power Company system."

Plant started in 1931

Total cost of new construction on the power project, begun in 1931, will be $2,400,000, Mr. Robinson said. Capacity of the plant is 18,000 kw.

Other items in the 1937 construction budget include $250,000 for rural extension, increasing substation capacities at various plants in the company's system, installation of additional voltage regulators and provisions for increasing primary and secondary power line capacities.

"During 1936 the Idaho Power Company built 202 miles of new rural lines for 729 new customers," Mr. Robinson said, "which extensions supplement the 65 per cent rural electrification already established."

Construction of the diversion dam at Upper Salmon Falls was started in 1931 and plans for completion of the work were made in 1936, with testing of the ground in September. Construction was resumed early in December, and now there are nearly 200 men employed on the site, a number which will be doubled by the addition of contractor's crews.

The present incompleted dam will be finished and a diversion dam 1,300 ft. in length will cross the south river channel at the lower end of Dolman Island. A canal which will carry 6,500 sec.ft. of water to the power plant is the second major part of the construction. Two 9,000-kw. generating units will be installed, together with a bank of 132,000-volt transformers. Thirty-five miles of 132,000-volt transmission line will link the new plant with Idaho Power's interconnected system at the site of the Shoshone Falls power plant. The project is in charge of H. L. Senger, chief engineer, and Ed Woodhead, general construction foreman of the Idaho Power Company.

Work on the canal, the diversion dam and excavation for the power plant will be done under contract and will employ about 200 men. One-half million cubic yards of dirt will be removed during construction of the canal, which in operation will carry 2½ times as much as the New York Canal of the Boise project.

The new power plant will be located in Twin Falls County and will add an amount estimated at $50,000 to the annual property tax expenditure of the Idaho Power Company.

•

New Jersey Utility to Spend $23,000,000

Expenditures of upward of $23,000,000, the largest outlay since 1929, for replacements, new equipment and improvements have been prepared by the Public Service Corporation of New Jersey and its subsidiaries. About $18,000,000 will be spent by the electric and gas departments and $5,000,000 by Public Service Coordinated Transport.

Among the larger items in the construction budget of the electrical department are the installation at the Essex generating station, Newark, of a 50,000 - kw. superposed turbine-generator and two high-pressure, high-temperature boilers, also reconstruction of the switch house in which a fire recently caused a 5½-hour shut-off of power to most of Newark. A high-tension transmission line will be constructed between the Essex station and Metuchen to increase reliability of service. A second transmission line for the same purpose will be built between the Hudson switching station, Jersey City, and a site in Bergen County.

About $2,000,000 will be spent for continuance of the policy of placing electric distribution facilities underground. Provision also is made in the budget for a new substation at Hillside and other facilities.

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Maltbie Accepts Bid for McNinch Hearing

The New York Public Service Commission has expressed its willingness to hold public hearings at which Frank R. McNinch, chairman of the Federal Power Commission, can present "legal proof" of his recent assertion that electric rates in New York City are excessive.

Milo R. Maltbie, chairman, stated that the commission would hold a legally constituted public hearing at the earliest date Mr. McNinch might suggest and that the New York statutes and the commission's rules govern the proceedings.

Four of the five conditions laid down by Mr. McNinch were accepted, the fifth, that the state commissioners be subject to examination, was rejected as "without precedent," "strange," "novel" and "beside the point."

•

Utilities to Aid Recording Totals in Polls by Radio

Radio listeners in the future may express their opinion on any public question and have the totalized results known almost instantly through the development by Dr. Nevil Monroe Hopkins of a self-setting relay for attachment to a radio set. This relay starts a very small induction motor which applies in a step-by-step manner a highly inductive incremental load the integration of which by the power company will give the voting count.

The relay may be automatic for recording listener interest in any program or push button for yes and no voting on a particular question.

Robinson-Patman Act Seen Raising Prices

Although the Robinson-Patman act will not directly affect industrial buying, as was stated by George A. Renard, secretary of the National Association of Purchasing Agents, at the meeting of the public utility group of the association in Chicago recently, it was generally felt by those present that the trade restrictive tendency of government, indicated by the act, will inevitably result in higher costs and higher prices in all fields. That is, the fear of restrictive legislation, even though none is passed, will hamper the natural working of competitive forces and thus tend to push up prices.

The two-day meeting of the group drew an attendance of about sixty public utility purchasing agents from all over the country—a good showing that proved the concern generally felt about price trends in the present condition of business intimidated by politics. All of the sessions were closed.

An idea of the matters that engaged attention can be gained from the program that included symposia on the Robinson-Patman act, public utility purchasing procedure and on special purchasing problems. Papers were presented and addresses made by John D. Noyes, Detroit Edison Company, on the "Code-Approval-Ordinance Program of the Electrical Industry"; by Fred Carpi, Pennsylvania Railroad, on "Railway Door-to-Door Pick-up Systems"; by H. Le Roy Whitney, the M. W. Kellogg Company, on "High and Low Pressure Joints and Mechanical Couplings," and by Professor Myron H. Umbriet, Northwestern University, the "Economist Looks at the Public Utilities."

•

Power Salesmen Meet on Method Problems

High sales pressure maintained on competitive methods of power supply can be offset only by the same kind of action by the electric utilities if they wish to remain unimpaired and to increase their sales of energy to industrial customers. This was the gist of the remarks of J. O. Peck, McGraw-Hill Publishing Company, at the meeting of the Great Lakes Power Club in Chicago recently. Mr. Peck showed an impressive exhibit of current Diesel engine advertising. He offered several suggestive layouts indicating how the utilities might advertise their service.

Ability to make friends of his customers so that they will like and trust him is the prime requisite in a power salesman, said H. T. Dixon, Public Service Company of Northern Illinois. Engineering and sales ability are necessary, but engineering and economic facts have no effect on a man who distrusts their source and salesmanship has hard sledding when opposed by indifference or dislike. But no power salesman ever lost a customer who was also a friend, he said. E. W. Atkinson, of the same company, discussed air conditioning, which was taken up by the group.

W. J. Kyle, Public Utility Engineering & Service Corporation, reported on recent meetings of the Society of Heating and Ventilating Engineers and of the American Society of Refrigerating Engineers. Recent Diesel engine competition discussions was led by J. O. Coates, Consumers Power Company, with all present joining. Power factor clauses in rates and methods of power-factor correction was another subject that excited lively discussion, with a warning note on the dangers of resonance from static condensers during light and no load periods, uttered by C. D. Malloch, Consumers Power Company.

•

Lincoln Foundation to Award $200,000

A prize competition for scientific papers on arc welding, the winners of which will divide awards totaling $200,000, has been announced by the James F. Lincoln Arc Welding Foundation of Cleveland. The purpose of the contest is to encourage scientific interest in the thousands of uses to which arc welding may be put, according to the sponsors.

The contestants will prepare papers describing the redesign of existing machines, structures, buildings or similar construction through the use of arc welding. Participants may also present designs for new types of construction.

The awards consist of 446 prizes. The grand prize will be not less than $13,700. The contest will close on June 1, 1938.

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New Connecticut Power Bill

Representative Citron of Connecticut introduced last week in the House of Representatives a new Connecticut Valley Authority bill proposing to combine the generation of electric power with flood control and navigation. A similar bill was introduced in the House by Mr. Citron two years ago.

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New Utility Office Created

Stockholders of the United Illuminating Company, New Haven, Conn., have voted to amend the charter creating the office of chairman of the board of directors.

Lincoln Electric Co.

SEVEN-NOSED MAMMOTH—Arc-welded inlet manifold to the Gene pumping station on the $236,000,000 Colorado River Metropolitan Water District Aqueduct, scheduled for completion next year. The giant arc-welded steel pipe was fabricated by Consolidated Steel Corporation, Los Angeles

Cedar Association Names Clute Head

Members of the Northern White and Western Red Cedar Association at their convention in Minneapolis elected R. V. Clute, Weyerhaeuser Pole Company, president; W. M. Leavitt, Leavitt, Naugle Pole Company, vice-president, and H. F. Partridge, T. M. Partridge Lumber Company, treasurer. C. D. Manson was reappointed secretary-manager.

Directors elected included G. H. Ramsey, National Pole & Treating Company; M. J. Bell, Jr., Bell Lumber & Pole Company; L. D. McFarland, L. D. McFarland Company, Ltd.; M. H. Sperry, Valentine Clark Corporation; Mr. Clute, Mr. Leavitt and Mr. Partridge.

•

Rural Wire Hazards Group to Be Formed

The rapid extension of rural electrical service throughout the country has brought about a desire on the part of fire prevention interests to provide for safer installations of wiring. A committee of about eight members is new being formed under the auspices of the National Fire Protection Association to consider the drafting of a standard wiring ordinance applicable to farm line and service layouts. Michigan has already framed a wiring ordinance for this type of work.

Franklin H. Wentworth, managing director of the association, stated that the committee will include membership identified with the electrical industry, fire wardens and others concerned with establishing better wiring in areas beyond the reach of the existing municipal inspection organizations.

•

Big Electric Show for Hub

Although oldtimers in Boston still talk about the "1912 Electric Show" as a landmark in promotional display, the newer generation of industry representatives has determined to put on a show this fall which will surpass all previous efforts in New England to make the public electrically minded. "Jack" Caddigan of the Boston Edison Company's sales organization has been made acting chairman of a committee including W. V. Price, F. X. Fitzpatrick, Louis A. Fiorani, John W. Scott, Edward G. Rigby, J. J. Burke, L. Sincock, J. J. Slattery, G. W. McShane, R. P. Taylor, Bayard W. Robertson and L. T. Maloney in active membership, and representing every branch of the electrical industry.

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Supreme Court Declines to Review Power Issue

The U. S. Supreme Court on February 15 declined to review a lower court decision refusing to enjoin the construction of a hydro-electric power project on the All-American Canal in California by the Imperial Irrigation District.

The suit was brought by the Nev-Cal Electric Securities Company, which charged that the district planned to serve the town of Brawley, Calif., and nearby territory and that this was beyond the powers granted to the district as a public corporation.

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Holding Unit Probe Ordered

Federal Judge William H. Holly has ordered a court investigation of the Utilities Power & Light Corporation, a holding company seeking to reorganize under Section 77b of the Bankruptcy Laws. The United States District Attorney's office and the S.E.C. also have projected inquiries into the affairs of the corporation. The corporation sought authority to continue in possession of its properties pending reorganization.

Meetings

American Society for Testing Materials—Committee Week, Palmer House, Chicago, Ill., March 1-5. R. E. Hess, assistant secretary, 260 South Broad St., Philadelphia, Pa.

National Fire Protection Association—Electrical Committee, Atlantic City, N. J., March 9-12. A. R. Small, chairman, 207 East Ohio St., Chicago, Ill.

National Oil Burner and Air Conditioning Exposition — Philadelphia, Pa. March 15-19, C. F. Curtin, exposition manager, Oil Burner Institute, 30 Rockefeller Plaza, New York, N. Y.

Oklahoma Utilities Association—Annual convention, Mayo Hotel, Tulsa, Okla., March 22-23. Kate A. Niblack, acting secretary, 625-626 Biltmore Hotel, Oklahoma City, Okla.

Northwest Electric Light & Power Association—Business Development Section, Salt Lake City, Utah, March 25-27. George H. Wisting, section chairman, Northwestern Electric Company, Portland, Ore.

$100,000,000 Suit by Utility Advised

Recommendation that suit be filed to recover more than $100,000,000 of assets for the Standard Gas & Electric Company was made last week to Judge John P. Nields in the United States District Court in Wilmington, Del., by William G. Mahaffey of Wilmington and William H. Button of New York, special counsel appointed by the judge. They recommended that the suit be entered against H. M. Byllesby & Company, Ladenburg, Thalmann & Company and the United States Electric Corporation, either in the name of Standard Gas & Electric or in the name of a trustee to be appointed.

Last year Judge Nields granted permission to the corporation to remain in possession of its assets in accordance with Section 77b of the Federal Bankruptcy Laws and enjoined the entering of any suits against the corporation pending reorganization. Permission was later sought by certain prior preference stock holders who maintained it was imperative that an action be taken, charging that Byllesby & Company had conspired to buy assets and stocks of corporations and sell them to Standard at a huge profit to themselves.

In the report special counsel told the court there are ample grounds for action being brought before final settlement of the reorganization plan. Judge Nields has fixed no time for action on the recommendations.

•

Independent Offices Bill

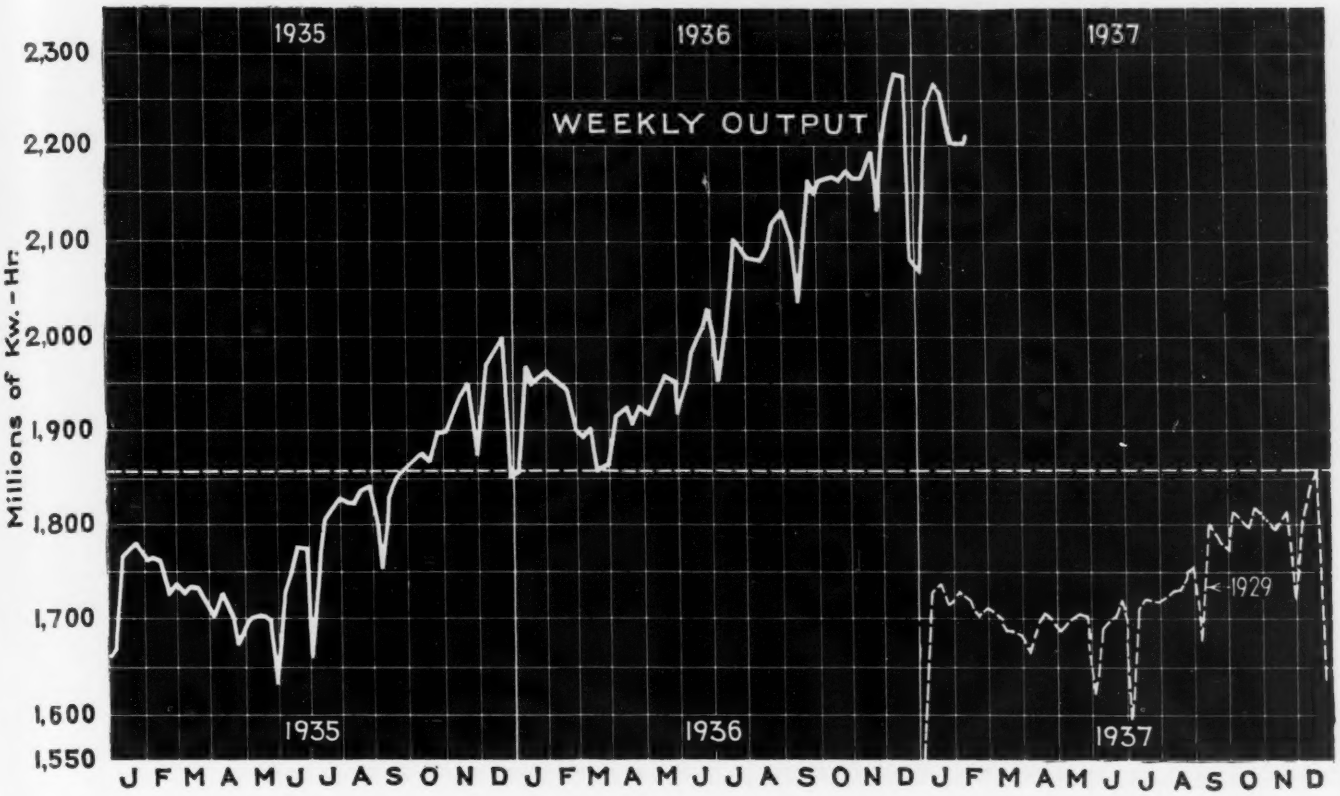
Last week the Senate passed the $971,000,000 Independent Offices Appropriation Bill without a rollcall. Included in the provisions is an appropriation of $31,520,000 for the Rural Electrification Administration and of $1,525,000 for the Federal Power Commission.

•

Santiam River Plant

Mountain States Power Company will start construction on a $50,000 power plant on the Santiam River, Stayton, Ore., according to Harry J. Rowe, manager. The new plant will have a capacity of 700 hp. and is to replace the one destroyed by fire in 1929. Approximately 1,000 customers will be served.

Output 13.4 per Cent Over Last Year



Reversal of the recent downward trend sent the output of the electric light and power industry up to 2,211,818,000 kw.-hr. in the week ended February 20 and increased the margin over the like week a year ago to 13.4 per cent, according to figures announced by the Edison Electric Institute. Prior to 1936 the maximum for the week was 1,769,683,000 kw.-hr. in 1930. This has now been exceeded by 442,125,000 kw.-hr., or 25 per cent.

The gain over 1936 increased in all parts of the country except the West Central, where it dropped from 6.3 per cent in the week of February 13 to 5.4 per cent, and in the Pacific states, where a negligible decline was registered. In the Central industrial area a distinct rebound is revealed in the rising percentages of the past two weeks, the gain beginning with the week of January 16 being successively 18, 19, 15, 14, 16 and 17.6 per cent.

Weekly Output, Millions of Kw.-Hr.

1937	1936	1935
Feb. 20...2,212	Feb. 15..1,950	Feb. 16..1,761
Feb. 13...2,200	Feb. 8..1,952	Feb. 9..1,764
Feb. 6...2,201	Feb. 1..1,963	Feb. 2..1,763
Jan. 30...2,215	Jan. 25..1,956	Jan. 26..1,782
Jan. 23...2,257	Jan. 18..1,950	Jan. 19..1,778
Jan. 16...2,264	Jan. 11..1,971	Jan. 12..1,773

Per Cent Change from Previous Year

	Week ended		
Region	Feb. 20	Feb. 13	Feb. 6
New England.....	+15.4	+14.5	+13.9
Middle Atlantic....	+11.8	+11.5	+10.9
Central Industrial.	+17.6	+16.0	+14.0
West Central.....	+ 5.4	+ 6.3	+ 7.3
Southern States...	+12.8	+11.9	+ 9.6
Rocky Mountain..	+10.9	+ 7.0	+ 5.8
Pacific...........	+10.5	+10.6	+11.5
United States...	+13.4	+12.7	+12.1

$80,000,000 Issue Indorsed

Stockholders of the Public Service Company of Northern Illinois at their annual meeting on Tuesday approved a plan to issue under a first lien and refunding mortgage a new series of bonds not to exceed $80,000,000. Proceeds will be applied to refund or retire all or a substantial part of the existing mortgage indebtedness.

•

General Electric Raises Pay

About $420,000 a year will be added to the General Electric Company's payroll at Schenectady, N. Y., according to E. D. Spicer, works manager. The pay rise will affect about 5,000 shop employees in the day-work class. An increase in wages for a group of 2,650 employees at the Lynn, Mass., works, totaling $200,000 annually, will be made.

•

Vevay Municipal Power Plant Slides Into River

The Vevay, Ind., power plant collapsed and slid into the river when it was weakened by the recent Ohio river floods. Twenty employees inside the plant escaped without injury. The city was without water nearly a week and had only part light service.

The municipally owned plant of the Vevay Electric Light & Water Works was of 200 hp. oil engine and of 130 kw. The plant served 326 meters.

1936 Reports Issued by Manufacturers

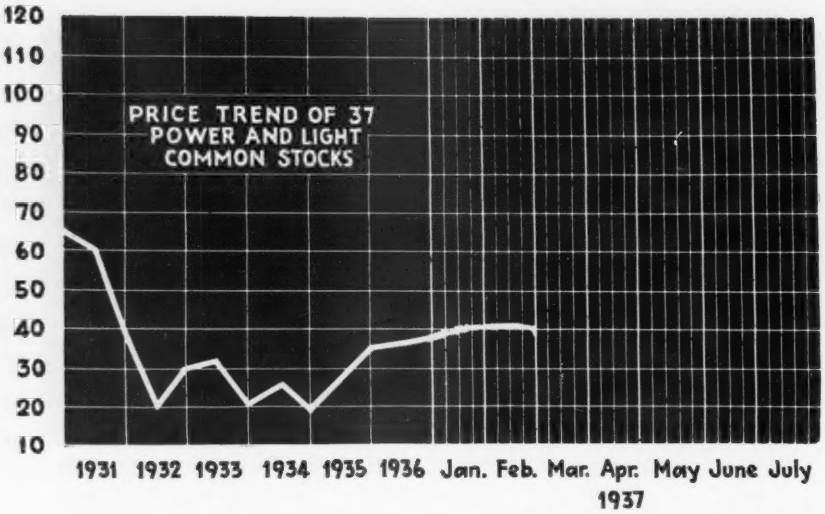
Among the electrical manufacturers issuing reports recently for the year 1936 are the following:

Arrow-Hart & Hegeman Electric Company—Net income $953,600, equal, after dividend requirements on 6 per cent cumulative preferred stock, to $4.44 each on 200,000 shares of $10-par common stock, compared with $643,556, or $2.70 a common share, the year before.

Reliance Electric and Engineering Company—Net profit, after federal surtax on undistributed income $366,182, compared with net profit in 1935 of $178,110.

Cutler Hammer Company, 50 cents on common, against $1 extra and 25 cents quarterly on December 15, 50 cents extra and 25 cents quarterly on September 15 and 25 cents extra in addition to a quarterly of that amount on June 15.

Light and Power Stocks Lose Ground



The stock list weakened this week and prices dropped to lower levels. Utility issues shared in the general decline. "Electrical World" index, 38.9; last week, 39.6

Niagara Hudson Power Units to Consolidate

Fourteen operating companies of the Niagara Hudson System serving central, northern and eastern New York have filed with the Public Service Commission a petition for consolidation, in an additional step toward the further simplification of the system. The proposed consolidation would eliminate fourteen companies and reduce to 22 the number of system companies, as compared with the 68 existing shortly after the formation of the Niagara Hudson Power Corporation in 1929. The fourteen companies involved in the consolidation:

New York Power & Light Corporation, Antwerp Light & Power Company, Baldwinsville Light & Heat Company, Fulton Fuel & Light Company, Fulton Light, Heat & Power Company, Malone Light & Power Company, Northern New York Utilities, Inc., Old Forge Electric Corporation, Peoples Gas & Electric Company, St. Lawrence County Utilities, Inc., St. Lawrence Valley Power Corporation, Norwood Electric Light & Power Company, Syracuse Lighting Company, Inc., and Utica Gas & Electric Company

The plan provides for a new company which will propose revised electric rates for the territory now served. The capital stock of the new corporation at the date of consolidation is to be $91,182,225, a sum which does not exceed that of the companies to be merged.

The petition stated that "the benefits that will result from the ability of the consolidated corporation to finance the present and future capital requirements of the constituent corporations and refund present outstanding obligations in a more advantageous manner will be in the public interest."

The territory in which the fourteen companies operate is contiguous and their transmission facilities are interconnected. Practically all of the common stock of the companies is owned by Niagara Hudson Power Corporation.

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$130,000,000 Issue Filed with S.E.C.

Philadelphia Electric Company has filed a registration statement with the S.E.C. covering $130,000,000 of first and refunding mortgage bonds due in 1967. The interest rate and the public offering price are to be announced later. Net proceeds from the sale of the bonds, with sinking-fund money and treasury funds, will be used for refunding outstanding indebtedness. The financial transaction is one of the largest to come before the S.E.C. since its inception.

The Public Service Commission recently authorized the company to borrow $37,000,000 from banks and trust companies in Pennsylvania and New York on notes dated March 31, 1937, maturing on April 1, 1938, and bearing interest at 1½ per cent a year.

American Service Company of Savanna, Ill., has filed a declaration under the Utility Holding Company Act with respect to its organization as a subsidiary service company for the holding company system of American Utilities Service Corporation, a registered holding company. American Service Company also filed a declaration, covering the issuance of 100 shares of $10 par value common stock and a $9,000 5 per cent demand promissory note. The stock is to be purchased for cash by American Utilities Service Corporation and the note will be payable to and purchased by that corporation.

•

Debentures to Be Redeemed

Pacific Lighting Corporation has authorized redemption April 1 by lot of $3,000,000 of the outstanding $10,000,000 of 4½ per cent debentures.

•

Preference Stock Converted

Columbia Gas & Electric Corporation has notified the New York Stock Exchange that 124,006 shares of its convertible 5 per cent cumulative preference stock had been converted into 620,030 shares of common stock before the close of business on February 15, at which time the conversion privilege expired. Up to the expiration date $12,400,600 par value of the convertible stock had been retired through the exercise of its conversion privilege, and there remains outstanding $12,402,000 par value of the 5 per cent cumulative preference stock without conversion rights, subordinate to the outstanding preferred stock, totaling $98,955,100 par value. Each share of the 5 per cent cumulative preference stock has the same voting right as each share of common stock.

•

Dividend Announcements

The following public utility companies have recently made dividend announcements:

North American Company 30 cents on the common stock, comparing with four quarterly dividends of 25 cents a share and an extra December dividend of 25 cents a share paid in 1936.

Engineers Public Service Company, dividends accrued and in arrears on various classes of no-par value stock: $3.75 a share on the $5 dividend convertible preferred stock, $4.12½ a share on the $5.50 cumulative preferred stock and $4.50 a share on the $6 cumulative preferred stock. Following payment of these dividends on April 1 the unpaid accumulations will amount to one year's full dividend requirements on each of the three series of preferred stock.

Commonwealth & Southern, 75 cents per share on its preferred stock $6 series, payable April 1 to stockholders of record at the close of business March 12.

WHERE SERVICE CONTINUITY IS VITAL

General Electric Type H rural distribution transformer with pellet-type lightning arrester

PERFECTION OF DETAIL

YOUR RESPONSIBILITY grows daily as your service is extended to loads where continuity is vital. Dependability of electric service—hence the quality of the equipment you use—was never more important. That is why there is deep significance to you in our rigid policy of building transformers with a "Perfection of Detail" which is reflected for years in almost unbelievably good operating records. General Electric, Schenectady, N. Y.

300-52

GENERAL ELECTRIC

Field OPERATING PRACTICES

New ideas and practices in the operation of well-designed, constructed and maintained plants and systems

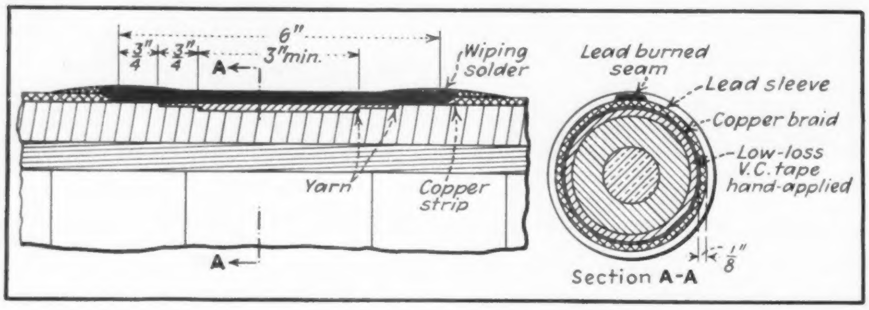
Sheath Repairs on 66-Kv. Cable

By HERMAN HALPERIN and R. J. PATTERSON

Commonwealth Edison Company, Chicago

On 66-kv. lines which have oil-filled joints and a supply of light oil feeding each joint sheath openings become quickly apparent after they develop due to abnormal loss of oil through the openings as indicated at the reservoirs or by the appearance of oil-soaked fireproofing in manholes, or both. The Commonwealth Edison Company found that it was economically desirable to make repairs wherever convenient, instead of incurring heavy costs incidental to replacements in the field or junking of cable, or both. Since December, 1930, repairs of this type have therefore been made in manholes, in specially exposed ducts and in the shop.

At the present time there are about 50 sheath repairs on 66-kv. cable which have been in operation from a few months to more than five years. Of this number, one-half were made on cable in manholes. A total of four repairs have been made which required the removal of more than the tentatively fixed limit of twenty layers; that is, from 40 to 82 layers of cable insulation (about 35 to 65 per cent of the cable insulation). Three of the latter cases were considered as temporary repairs made in the short time available and were removed only after a few days' operation when it became convenient to replace the cable.



To make a cable sheath repair

In the present method of making sheath repairs in duct or in the shop the layers of cable paper are removed in steps of five layers each until dry insulation is reached at the point of exposure This example shows removal of ten layers. Impregnated cotton yarn is wrapped in the step corners and ⅝-in. low-loss varnished cambric tape is applied up to the level of the original cable insulation. Taping compound is used liberally in applying this tape. The applied tape is completely shielded with a half-lapped wrapping of copper braid securely soldered to a copper sheath band placed under each end of the cable sheath. The split lead sleeve is fitted as shown, lead-burned along the longitudinal seam and wiped to the cable sheath at each end. No filling compound is used. Repairs in manholes are usually made by reinforcing and shielding in the manner just described, then applying varnished cambric tape over the shielding between the ends of the sheath to the cable sheath diameter, over which a split sleeve slightly longer than the removed piece of cable sheath is wrapped. This sleeve is entirely solder-sealed by wiping the overlapped ends of the sleeve and making a circumferential wipe at each end of it.

To determine the effect of replacement of different amounts of the original cable insulation, and also the effect of using different tapes, impregnated paper and low-loss varnished cambric in making the repairs, accelerated aging tests were made on two lengths of 66-kv. cable manufactured in 1927 and 1930 which had been in service and in which several test repairs were constructed. Four different repairs have been made on each of the two lengths, which came from different factories. In two repairs on each cable twenty layers (about 17 per cent) of the original insulation were removed and replaced in one case with impregnated paper tape and in the other with low-loss varnished cambric tape. Similarly in two other repairs on each cable 50 layers (about 38 per cent) of the original cable paper were replaced with paper and low-loss varnished cambric tape, respectively. The over-all lengths of the complete repairs were approximately 10 in. for the removal of twenty layers and 28 in. where 50 layers of original insulation were removed.

These test repairs have been subjected to about 50 daily heating cycles to maximum copper temperatures of 50 to 70 deg. C. with 2¼ or 2½ times normal voltage applied, mostly the latter. Measurements of power factor at room and elevated temperatures have been made daily, and the ionization factors at room temperatures between 15 and 95 kv. have also been frequently determined.

The test data show that in making sheath repairs on single-conductor cables operated at 66 kv. or less it is satisfactory to replace up to 30 or 40 per cent of the cable insulation, using either impregnated paper tape or low-loss varnished cambric tape for the hand-applied insulation. And for multiple-conductor cables operating at moderate voltages the same conclusion holds.

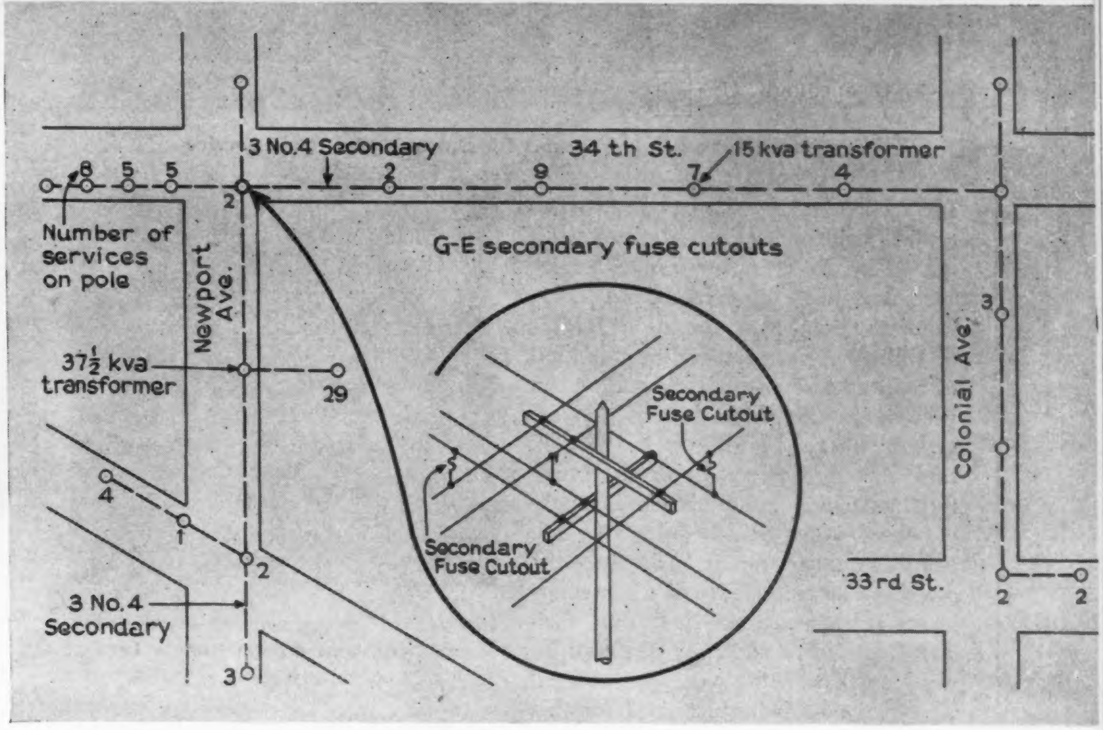
•

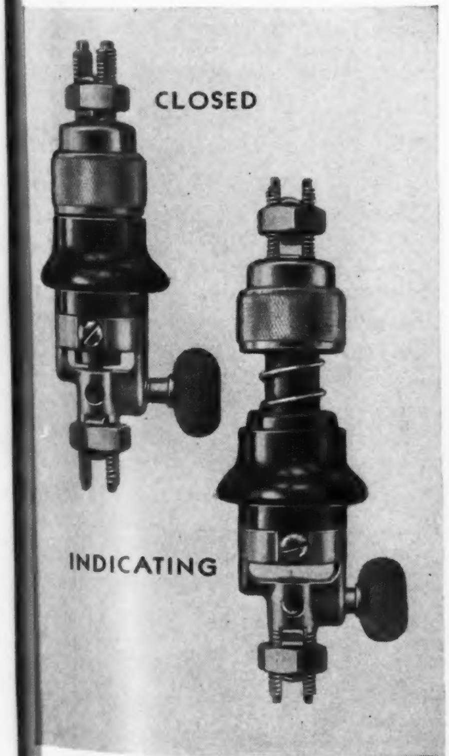
First Aid to Needy Ranges

If the Boston Edison Company can help it, no electric range user in its 600 square miles of territory will be allowed to miss three square meals

HERE'S AN EASY, ECONOMICAL WAY TO REDUCE LIGHT FLICKER

BANKING OF TRANSFORMER SECONDARIES USING G-E SECONDARY FUSE CUTOUTS

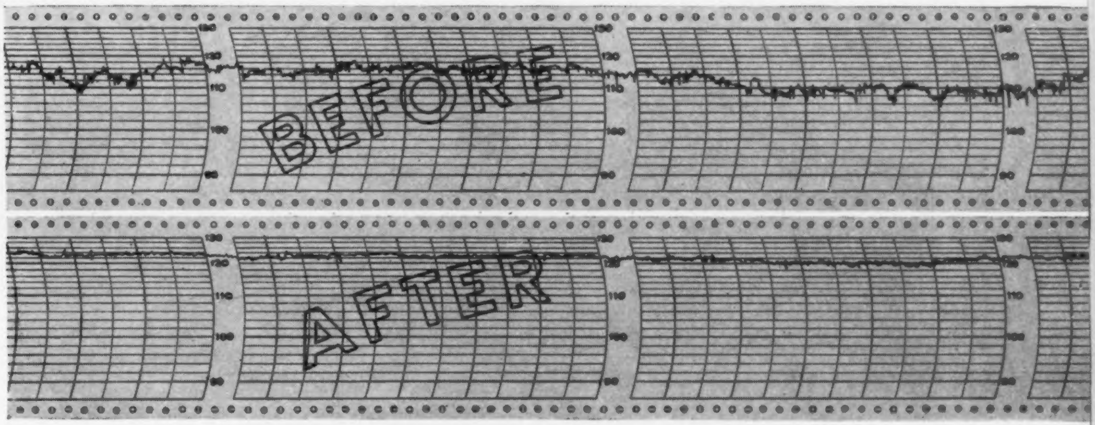

3 No.4 Secondary
34 th St.
15 kva transformer
8
5
5
2
2
9
7
4
2
Number of services on pole
G-E secondary fuse cutouts
Newport Ave.
3
37½ kva transformer
29
Secondary Fuse Cutout
Colonial Ave.
4
1
Secondary Fuse Cutout
2
3 No.4 Secondary
33 rd St.
2
2
3


CLOSED
INDICATING

G-E secondary fuse cutouts. When a fuse blows, the indication is plainly visible from the ground

BANKING of transformer secondaries helps overcome light flicker and enables higher loading with protection to transformers and service. G-E secondary fuse cutouts make secondary banking economical and practical. The cutouts are reliable, inexpensive, easily and safely installed. G-E secondary fuse links, for use in these cutouts, have characteristics which permit proper transformer loading without affecting ability to co-ordinate system fusing. Voltage levels are maintained when secondaries are banked, and the use of this scheme, in many cases, will obviate the necessity of installing additional transformers or larger secondary copper. For complete information on G-E secondary cutouts, ask for Bulletin GEA-2261B. General Electric, Schenectady, New York.

HOW VOLTAGE LEVELS WERE IMPROVED BY BANKING ON THE CIRCUITS SHOWN ABOVE



340-27

GENERAL ELECTRIC

Fleet of range repair sedans for Boston's high-speed service

for lack of emergency repairs to this major kitchen equipment from now on. Five fast-running range service sedans purchased from the Ford Motor Company went into operation July 1, establishing a new set-up for this kind of work in the Edison area. Based at present on the Massachusetts Avenue general service buildings in Boston, these cars are driven by expert range repairmen and are operated throughout the daytime on schedules aimed to complete range repair orders on the day these are received. At night emergency repairs are handled from various district operating centers by troublemen working with special fixed kit boxes now being designed for this service.

Each car carries about 200 varieties of supply items, the more important ones being carried in duplicate, triplicate or quadruplicate. Major items include coils, closed surface units, oven units complete, switches, adapter rings, relays, wire and fuses. All the leading makes of ranges used in the territory are covered in the stock assemblies. The heart of the set-up is a layout of portable and adjustable steel shelving built to company plans by the International Engineering Works, Framingham, Mass. By installing this on a horizontal axis space was obtained for one more tier of bins. The shelving can be easily readjusted to conform to changes in the design of the current styles of ranges marketed in the territory, and the layout of shelving corresponds to the alignment of range repair parts in a typical stockroom. A full set of tools and vise are carried on each vehicle. With the parts regularly stocked on each car, the driver can maintain contact with headquarters by telephone, and can thus complete a full day's work from the field. The sedan layout was planned by the distribution department. Special care was taken to provide ample space inside the vehicle for access to parts, the use of felting to reduce jarring of parts, and a special arrangement of padlocking to prevent leaving the doors closed and unlocked at the same time.

Interior of range repair car, showing shelving and compartments for supply service

Servicing Submerged Control Batteries

As a number of control batteries were submerged in New England during the recent flood period, the Boston office of the Electric Storage Battery Company sent many customers information as to the best methods of rehabilitating such units. The company found that cells of the sealed-in type in general best withstood the assault of water. The recommended servicing procedure follows:

1. Clean up the outside of batteries by hosing off with clean water. Dry and check over connections.

If vent plugs have been tightly in place while batteries were under water:

2. Remove vent plugs and check height of electrolyte. If more than ⅜ in. above tops of separators, take out excess.

3. Charge battery at normal rate until all cells are gassing evenly and show no rise in specific gravity readings. Continue charging for at least three hours longer.

4. If the specific gravity readings are then below 1.200 adjust to between 1.200 and 1.215 by removing some of the electrolyte and replacing it with 1.300 gravity electrolyte. Continue the charge for one hour. If the specific gravity is not then between 1.200 and 1.215, repeat the adjustment.

If vent plugs have not been in place while the battery was under water:

(a) Follow paragraphs 2, 3 and 4 for batteries which have been in use.

(b) For new batteries which have not been in service and where mud or silt can be seen on top of the plates

(c) Dump out electrolyte.

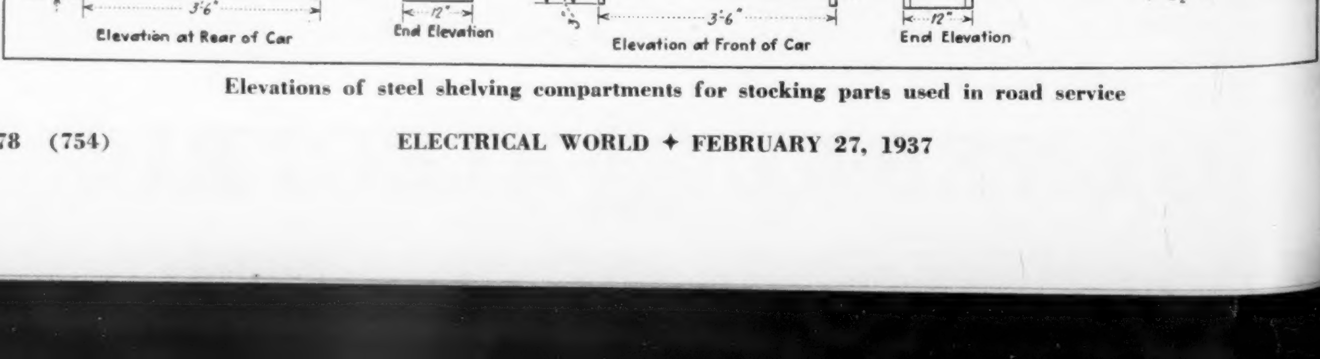
(d) Fill with clean water and dump again.

(e) Fill with 1.240 specific gravity electrolyte.

(f) Follow paragraphs 3 and 4 above.

Clean up batteries with oily rag to improve appearance.

It was found in many cases that where operating engineers disconnected the cells from the switchboard, trouble from electrochemical action at studs and other fittings was largely eliminated. Where this was not done, numerous cases arose in which the partial short circuiting of cells by polluted or chemically conducting



Elevations of steel shelving compartments for stocking parts used in road service

Today **FH BREAKERS March On In STEEL**

TO GREATER SAFETY

TO GREATER SAVINGS

G.E. BUILDS WITH STEEL

COMPLETE MECHANICAL INTERLOCKING of breakers, disconnecting switches, and doors gives you definite assurance of safety.

ASSEMBLED COMPLETE when received, all in one unit, means installation takes less time and, therefore, costs less.

Further evidence of operators' confidence is shown by many recent installations. General Electric, Schenectady, New York.

FH cubicles installed

890-25

GENERAL ELECTRIC

water which reached the panels caused much damage during the period of exposure.

Battery engineers state that in future station design it should be feasible to locate batteries far above the basement levels formerly common to such equipment. Improved cell design has made it unnecessary to locate batteries in such places to get rid of fumes and odors, and facilities for quick removal of batteries from threatened areas in plants will probably be included in later work.

Many resourceful methods of charging batteries were utilized in the flooded areas. Arc-welding generators were pressed into service at the Hartford office of the Southern New England Telephone Company. At the Boston & Albany Railroad station in Springfield, Mass., industrial electric truck batteries pressed into service for signal and track motor operation were charged from steam locomotive headlight generators supplied with steam from a locomotive brought into the station for this purpose.

•

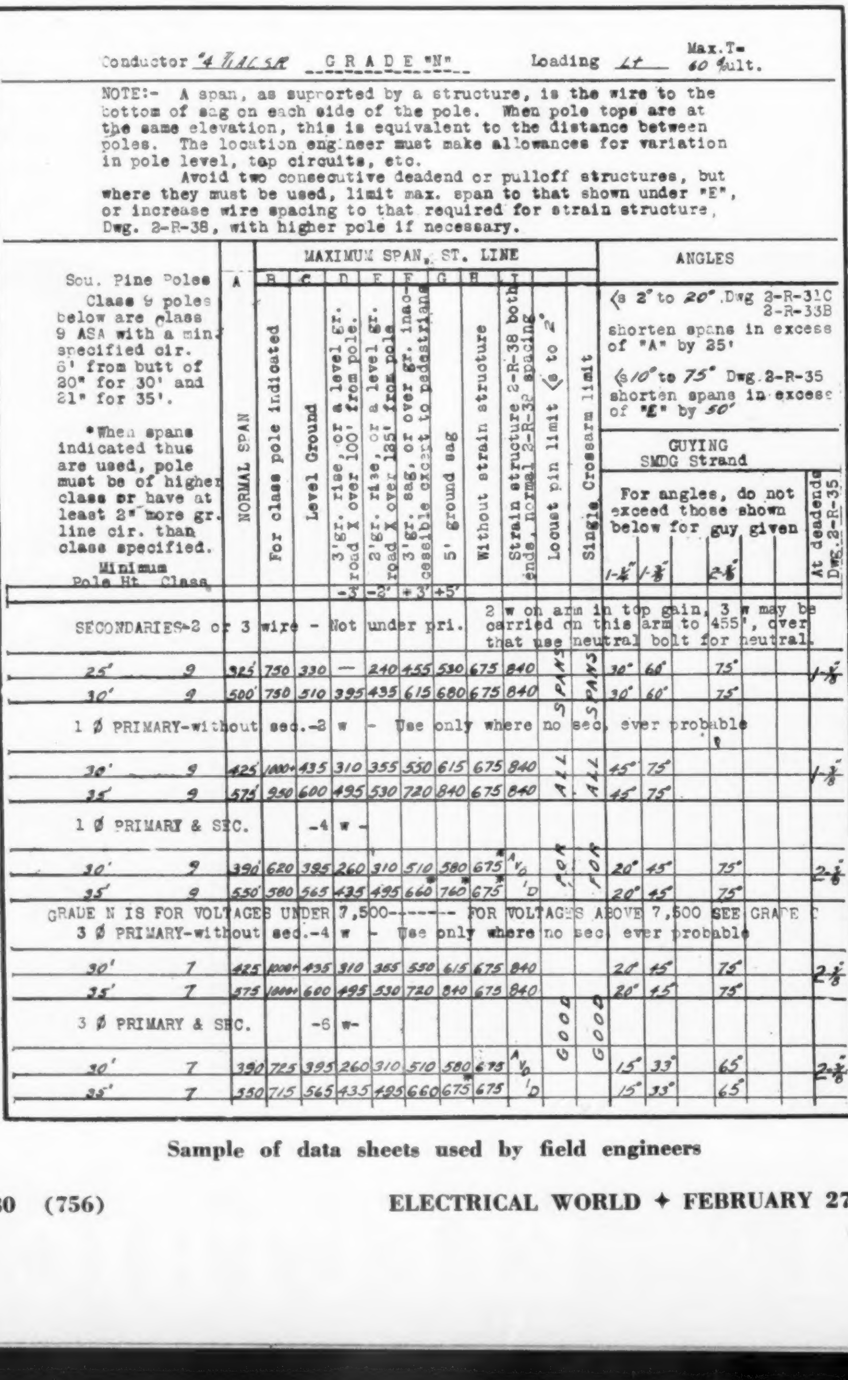
Location Sheets Help in Rural Line Costs

By E. A. BOWMAN

Bowman & Wages, Electric Distribution System Engineering, Roxie, Miss.

Design engineers and manufacturers have worked to lower costs and improve designs of rural lines, but their efforts can be quickly nullified by field line location that does not fully utilize the savings available through improved practices and materials. A competent location engineer should know his specifications, materials, costs and limits, but even a well-qualified man cannot carry the figures in his head for each and every structure, grade, loading and conductor commonly used.

To help this situation, we have found the accompanying "location sheet" of great value to engineers laying out lines under our specifications. As can be seen, it provides information as to the maximum span obtainable under a variety of normally encountered situations together with the poles and structures to use. Information is also provided as to angle structures and anchoring. We believe any company that will work out such sheets to suit its specifications will be more than repaid by the improved field location and savings its engineers can make.



Conductor #4 ¾ ACSR GRADE "N" Loading Lt Max.T= 60 %ult.

NOTE:- A span, as supported by a structure, is the wire to the bottom of sag on each side of the pole. When pole tops are at the same elevation, this is equivalent to the distance between poles. The location engineer must make allowances for variation in pole level, tap circuits, etc.

Avoid two consecutive deadend or pulloff structures, but where they must be used, limit max. span to that shown under "E", or increase wire spacing to that required for strain structure, Dwg. 2-R-38, with higher pole if necessary.

Sou. Pine Poles
Class 9 poles below are class 9 ASA with a min. specified cir. 6' from butt of 20" for 30' and 21" for 35'.

*When spans indicated thus are used, pole must be of higher class or have at least 2" more gr. line cir. than class specified.

ANGLES

∢s 2° to 20°. Dwg 2-R-31C 2-R-33B shorten spans in excess of "A" by 25'

∢s 10° to 75° Dwg. 2-R-35 shorten spans in excess of "E" by 50'

GUYING SMDG Strand

For angles, do not exceed those shown below for guy given

Minimum Pole Ht.	Class	A NORMAL SPAN	B For class pole indicated	C Level Ground	D 3' gr. rise, or a level gr. road X over 100' from pole.	E 2' gr. rise, or a level gr. road X over 135' from pole	F 3' gr. sag, or over gr. inaccessible except to pedestrians	G 5' ground sag	H Without strain structure	I Strain structure 2-R-38 both ends, normal 2-R-32 spacing	Locust pin limit ∢6 to 2°	Single Crossarm limit	1-¼"	1-⅜"		2-⅜"			At deadends Dwg. 2-R-35
					-3'	-2'	+3'	+5'											
SECONDARIES-2 or 3 wire - Not under pri.										2 w on arm in top gain, 3 w may be carried on this arm to 455', over that use neutral bolt for neutral.									
25'	9	325'	750	330	—	240	455	530	675	840	SPANS	SPANS	30°	60°		75°			1-⅜"
30'	9	500'	750	510	395	435	615	680	675	840			30°	60°		75°			
1 Ø PRIMARY-without sec.-2 w - Use only where no sec. ever probable																			
30'	9	425'	1000+	435	310	355	550	615	675	840	ALL	ALL	45°	75°					1-⅜"
35'	9	575'	950	600	495	530	720	840	675	840			45°	75°					
1 Ø PRIMARY & SEC. -4 w -																			
30'	9	390'	620	395	260	310	510	580	675*	Avo	FOR	FOR	20°	45°		75°			2-⅜"
35'	9	550'	580	565	435	495	660*	760*	675*	iD			20°	45°		75°			
GRADE N IS FOR VOLTAGES UNDER 7,500------- FOR VOLTAGES ABOVE 7,500 SEE GRADE C																			
3 Ø PRIMARY-without sec.-4 w - Use only where no sec. ever probable																			
30'	7	425	1000+	435	310	355	550	615	675	840			20°	45°		75°			2-⅜"
35'	7	575	1000+	600	495	530	720	840	675	840			20°	45°		75°			
3 Ø PRIMARY & SEC. -6 w-											GOOD	GOOD							
30'	7	390	725	395	260	310	510	580	675	Avo			15°	33°		65°			2-⅜"
35'	7	550	715	565	435	495	660	675*	675	iD			15°	33°		65°			

Sample of data sheets used by field engineers

•

Lighter Equipment for Cable Pulling

By E. R. VIETZEN

Commonwealth Edison Company, Chicago

Steel cable-pulling equipment of the Commonwealth Edison Company has been about half replaced with an aluminum alloy type of considerably lighter weight. A set of pulling equipment consists mainly of two 5-in. "I"-beams, each 14 ft. in length, and two 16-in. diameter sheave wheels. After the uprights have been placed in the manhole, with the sheave wheels in position between them, they are braced at the bottom and anchored near the top with an anchor which pulls against the manhole roof. The steel uprights and sheave wheels each weighs 200 lb. and 75 lb. respectively, while the aluminum alloy equipment has reduced these weights to 69 and 50 lb.

The aluminum alloy equipment has been used daily for several months. For the greater part of the cable-pulling work the alloy uprights are as serviceable as those of steel, but where very severe pulling strains are encountered more care must be exercised in bracing them in order to avoid deformation. However, it is planned to replace the remainder of the steel-pulling equipment with the 5-in. aluminum uprights having a slightly heavier section, which is expected to eliminate any extra bracing for severe pulling strains. Because of the fact that the pulling equipment is installed in and removed from manholes several times a day, the aluminum alloy type has proved valuable from the standpoint of ease and increased speed in the handling of it and reduction in the chances of accidents.

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uality of products will be under the con-
tant control and supervision of the Gen-
ral Cable Research Laboratories, to assure
niformity and excellence of finished wires.

everal states will welcome this announce-
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o the door of consumption. We in turn are
ppreciative of the continuing patronage
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Industrial ELECTRIFICATION

New ideas and practices in industrial electrification as presented by industrial, consulting and power sales engineers

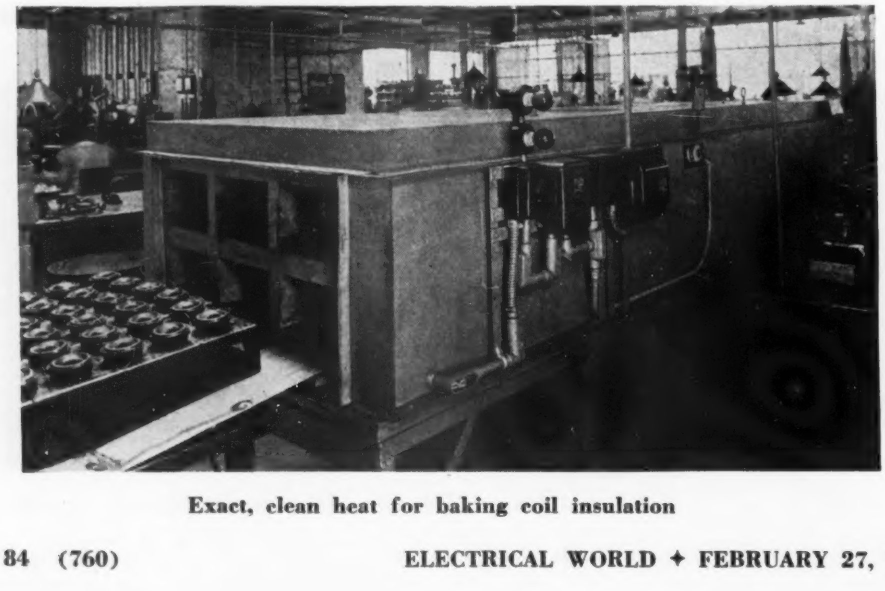
Electric Oven Pays Out Quickly

By **H. R. STEVENSON**
Detroit Edison Company, Detroit, Mich.

Replacing a fuel-fired installation in a Detroit plant, a well-insulated electrically heated oven has more than returned its cost of construction in a few months, not only because of decreased operating cost but also because of the improved working conditions its introduction has caused in the plant. It is of the continuous batch type, wherein the product, (ignition coils) is loaded in racks, and as each rack is introduced through the charging aperture it pushes the rack already in the oven farther on its way toward the other end.

Temperature control is automatic, and since the heating is done with strip heaters well distributed throughout the oven, a nice uniformity of temperature is obtained. It is used for baking and drying out the ignition coils before the sealing compound is poured into the shell.

Equipped with 7.5 kw. of heat, the operating cost has been placed at $18 per month, which, according to the owner, is but a quarter of the cost of operation of the previous fuel-fired equipment.



Exact, clean heat for baking coil insulation

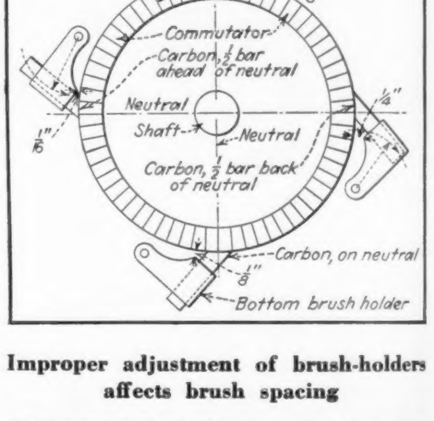
•

Scheme Facilitates Proper Brush Spacing

By **J. M. S. DEAN**
Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

Shop men in charge of electrical maintenance appreciate the importance of correct brush spacing to insure good commutation. To this end electrical machines fitted with sliding box-type brush-holders supported on studs or pins should be carefully checked. The following points deserve attention:

1. Brushholder studs must be spaced equally and the same distance from the commutator face.



Improper adjustment of brush-holders affects brush spacing

Right-hand brush-holder is too far from commutator face; left-hand brush-holder is too near commutator face; top and bottom brushes are properly adjusted.

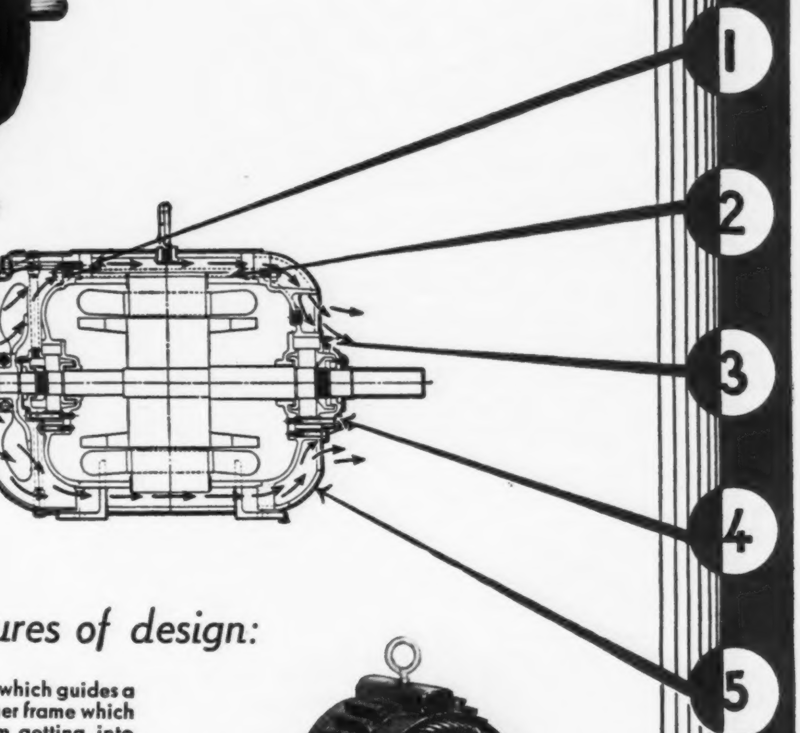
2. Studs must be parallel to the axis of the commutator.
3. Where more than one brush-holder is on a stud they should be accurately lined up.
4. Brush-holders must be set so that boxes are no less than $1/8$ in. from the commutator face.

Point (4) is important, especially where brushes are set at an angular position as shown in the accompanying sketch. To illustrate this point the right-hand brush-holder is shown swung too far from the commutator face. This shifts its brush back of the neutral position about one-half commutator bar. The left-hand brush-holder is swung too near the commutator face, which shifts its brush about one-half commutator bar ahead of the neutral position. Top and bottom brush-holders are properly spaced.

A method for finally checking brush spacing on a machine after the above adjustments have been made is outlined as follows:

1. Prepare a strip of paper the width of the brush track and in length equal to the

Wagner Type CP Motors
Require Minimum Maintenance



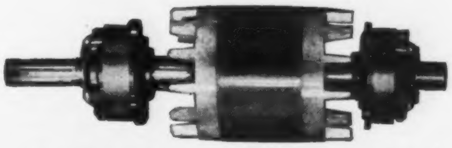
HERE'S WHY!

Examine the cross-section of a Wagner type CP totally-enclosed fan-cooled motor and see why this motor, year in and year out, under all types of atmospheric conditions, will continue to carry the load—free from unnecessary shutdowns and maintenance.

Note the following salient features of design:

1. It is provided with two frames—an outer frame which guides a strong cooling draft over the motor—and an inner frame which prevents anything obstructive or injurious from getting into the motor.
2. Rugged, welded all-steel stator with specially impregnated and fully taped winding, and deeply grooved periphery to increase radiating surface.
3. Easily accessible grease plugs on both ends of motor with special arrangement on fan end to permit lubrication without removing fan shield and without shutting down the motor.
4. Full cartridge-type bearing construction which completely seals and protects the ball bearings.
5. End-plates direct the ventilating air against the bearings, keeping them very cool.

Wagner Type CP stator _ built to meet the exacting requirements of hard, continuous service.



Wagner Type CP rotor _ balanced to insure freedom from vibration; cast aluminum blowers, bars and rings; built substantially to operate smoothly, efficiently and dependably.

There are many other features of superiority of Wagner type CP motors. Write today for your copy of Bulletin 182, Part 4C.

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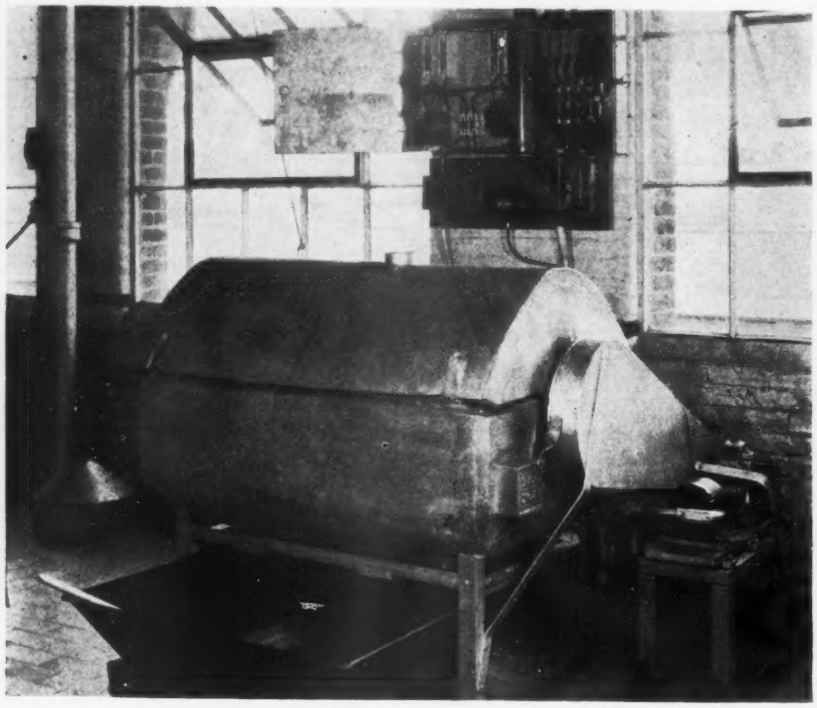


In roasting nuts for use in ice cream a problem encountered bv the H. P. Hood & Sons Company, Boston, Mass., was that of supplying the exact amount of heat needed for roasting the nuts and at the same time preserve the essential oils. In solving it, automatically controlled strip heating units were placed in the nut-roasting machine illustrated. Result—the electric units supply the exact amount of heat needed, without danger of overheating.

circumference of the commutator plus about ½ in. to make a lap joint.

2. Apply this strip to the commutator face and mark off the starting line.
3. Remove the strip and divide the distance around the commutator into as many parts as brush studs by drawing across the paper from side to side.
4. Replace the strip on the commutator and move so that one of the division marks lines up with front edges of brushes in one of the holders.
5. Adjust other brushes so that they line up with their respective divisions.
6. Remove paper and seat brushes on the commutator face.

•

Welds Not Brittle at Low Temperatures

Whether or not welds in steel have a tendency to brittleness under shock at low temperatures was answered, in part at least, by Prof. Otto H. Henry of the Polytechnic Institute of Brooklyn, in a paper presented at the recent annual meeting of the American Welding Society. Tensile-impact tests, made on electrical resistance butt welds, atomic hydrogen welds and brazed joints—the parent metal being mild steel—indicate that there need be no hesitation in using these processes on structures intended to withstand shock during the cold weather.

After withdrawal from a cold bath the specimen is ruptured by a blow from a heavy pendulum and the relative brittleness or toughness is determined from the swing of the pendulum and the increase in length of the sample just before fracture.

The welds had tensile impact values at normal temperatures, as well as at 112 deg. below zero Fahrenheit, that were only slightly lower than the values for unwelded steel. Since the tests were made with specimens cut from plates welded in normal production, not specially made and not heat treated before testing, they prove that welds in mild steel are in no sense brittle and are but slightly inferior to mild steel at both normal and low temperatures.

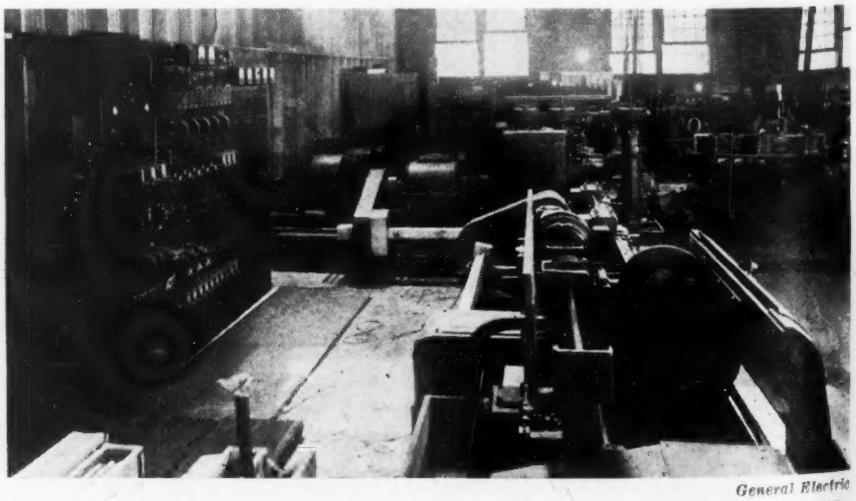
Since bronze is not as strong as mild steel, the tensile impact values of the brazed joints were inferior to those of the welds. The difference was not great, however, and the tests showed that brazed joints are not brittle at low temperatures.

•

Forming Machine Uses Variable-Speed Drive

A five-strand continuous forming machine for the rolling of commutator-bar copper and similar shapes, installed at Revere Copper & Brass, Inc., Rome, N. Y., is driven by motors of the direct-current type with adjustable-speed characteristics. Power is supplied through an adjustable-voltage system of control with a separate motor-generator set providing a wide range of speed. The mill is capable of very accurate rolling over a wide range of shapes and sizes.

The forming machine, one of the latest types made by the Kane & Roach Company, Syracuse, N. Y., is driven by 230-volt, direct-current, adjustable-speed motors connected to each stand. Two of the motors are rated 40 hp., 850 to 1750 r.p.m. and three are rated 30 hp., 850 to 1,750 r.p.m.



General Electric

Direct-current motors on variable voltage control system provide adjustable speed for copper forming machine

RANGE
—THE WIDER IT IS, THE MORE WELDER YOU GET FOR YOUR MONEY
LINCOLN Shield Arc WELDER

TRY THIS NEW LINCOLN!

TRY the new *"Shield-Arc SAE"* with 3/32-inch electrode on 24-gauge sheet or, turn up the heat and use it with 3/8-inch electrode on heavy plate. Just try it on any kind of work . . . with any size electrode . . . and you will find this new Lincoln gives the widest range of welding arcs ever afforded by any one welder.

You will also find it *easier* to get *better welds* at *higher welding speed* throughout this *"Shield-Arc's"* extra wide range because its Dual Continuous Control permits the choice of *any type* of arc as well as *any size*, to suit each job individually.

This vastly improved welder performance is being realized in everyday practice by scores of users of the new *"Shield-Arc SAE."* May we arrange a demonstration for you? The coupon is for your convenience. THE LINCOLN ELECTRIC CO., Dept. U-337, Cleveland, Ohio. *Largest Manufacturers of Arc Welding Equipment in the World.*

THE NEW ARC WELDING TECHNIQUE

Any TYPE or SIZE of arc . . . as simple to get as a station on your radio. Here is the engine-driven "Shield-Arc SAE," *for use out in the field.*

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New ENGINEERING IDEAS

Discoveries, proposals and developments by electrical engineers and scientists in the field, the factory and the laboratory

Portable Equipment Speeds Relay Test

By A. R. VAN C. WARRINGTON
Switchgear Device and Relay Division,
General Electric Company,
Philadelphia, Pa.

Maintenance testing is a considerable part of the expense of an installation of distance relays. These relays are really a combination of undervoltage, overcurrent, directional, differential and timing relays. In order to test them, it has been customary to provide all the apparatus necessary to test any one type. Furthermore, in testing, a rather complete set of characteristics are usually taken. Departing from this practice, a portable test equipment is now used which simulates the line conditions and simplifies the testing by limiting it to actual fault conditions that may occur.

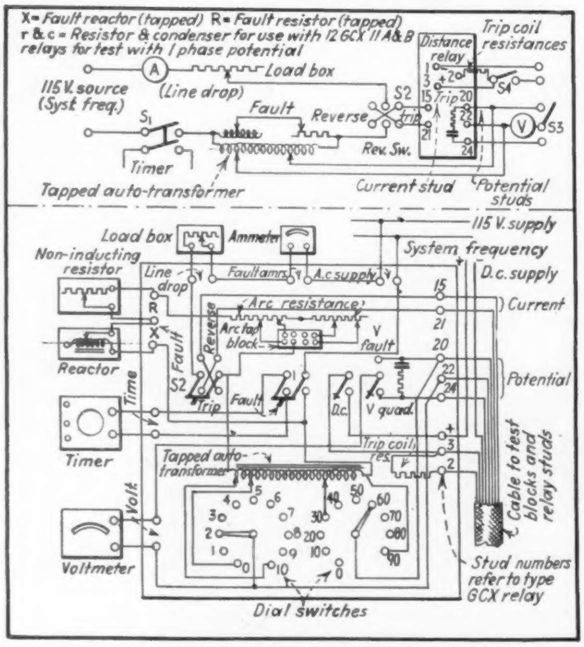
Instead of taking characteristics of the relay, it is connected in a circuit having the same secondary reactance and resistance as the protected section of line. Variations of generating capacity and power factor over the possible range are simulated by varying two rheostats, one in series with the circuit, representing generator reactance and line drop, and the other in series with the line reactor, representing fault reactance. In this way the behavior of the relay can be checked over all possible conditions in a few minutes and without calculation, except the multiplication of the fault reactance by a dial setting.

The equipment is light and compact and does not require shock-proof transportation. It can be used to test any distance relay, reactance or impedance, single phase or three phase, from a single-phase source of supply. It employs only one instrument, an ammeter, which does not have to be calibrated accurately nor read precisely as the setting of the relay is not based on calculations from instrument readings. The circuit connections can be made in a few minutes and, if test blocks are used, the test circuit can be transferred from one relay to the next without delay.

Applying fault conditions to a distance relay instead of taking relay characteristics is not only simpler and much quicker, but it is a more practical check on the relay's behavior in service. Equipment required for the new method is so much less that it has been made easily portable and much less expensive.

At right is schematic diagram showing circuit elements and below are actual connections. It will be noted that the fault resistance and reactance are connected across the full winding of a tapped step-down auto-transformer. This auto-transformer is provided with the equivalent of 100 equal taps (nine 10 per cent and ten 1 per cent) brought out to two dial switches so that the sum of their settings represent the percentage of the winding used. In testing relays the fault reactor is set at the nearest available value above the required reactance and then stepped down to the desired value by means of the auto-transformer. The fault current is controlled by the load box.

Arc resistance is simulated by an adjustable resistor inside the box. A resistor capacitor is shown in the diagram, connected across the upper and lower contacts of switch S-3. This serves to shift the potential so as to provide a three-phase supply to obtain the quadrature effect in three-phase relays though the power source be only single phase. For relays requiring only single-phase potential, this resistor-capacitor unit is not used.


X = Fault reactor (tapped) R = Fault resistor (tapped)
r & c = Resistor & condenser for use with 12 GCX 11 A & B relays for test with 1 phase potential
A
Load box
115 V. source (Syst. freq.)
(Line drop)
S1
Timer
Fault
Reverse
S2
trip
Rev. Sw.
Tapped auto-transformer
Distance relay
Trip coil resistances
1
3
2
15
Trip
20
21
22
24
S4
V
S3
Current stud
Potential studs
115 V. supply
System frequency
D.c. supply
Load box
Ammeter
Non-inducting resistor
Line drop
Fault amrs.
A.c supply
R
X
Arc resistance
Arc tap block
V fault
Reactor
Fault
Reverse
S2
Trip
Fault
D.c.
V quad.
Current
Potential
Time
Timer
Trip coil res.
Tapped auto-transformer
Volt
Voltmeter
Cable to test blocks and relay studs
Stud numbers refer to type GCX relay
Dial switches

Connections for test box and accessories for testing distance relays

•

Template Scheme Speeds Rate Studies

By E. H. BASHORE
and C. K. KRUCKELL
Rate Department,
New York Edison Company, Inc.

Considerable duplication of effort is frequently entailed in calculating and plotting curves used in making studies of the comparative costs of power under different rate classifications, particularly when the same curve must be drawn several times to serve as a base of comparison. To avoid this waste of effort the New York Edison Company has developed a series of celluloid templates from which rate curves that are most frequently encountered may be readily

THERE ARE *Design Features* THAT ASSURE POSITIVE DEPENDABLE PERFORMANCE IN

Protecting rural line transformer on 6900 V. circuit.

The TRIP OUT FUSE SWITCH

Consider these FEATURES OF OPEN TYPE SWITCHES

SOLDERLESS CON-NEC-TITES (for No. 2 solid) are used for upper and lower line connections.

●

MOUNTING BRACKET—permits the switch to be conveniently adjusted to face the operator.

●

TUBULAR INSULATOR, fog type design—made of plastic wet process porcelain; no cement used.

●

BUTTON HEAD FUSE CAP—makes positive, direct pressure contact with the upper terminal.

●

CARTRIDGE TUBE—is fibre lined, warp-resisting and is made of bakelite.

●

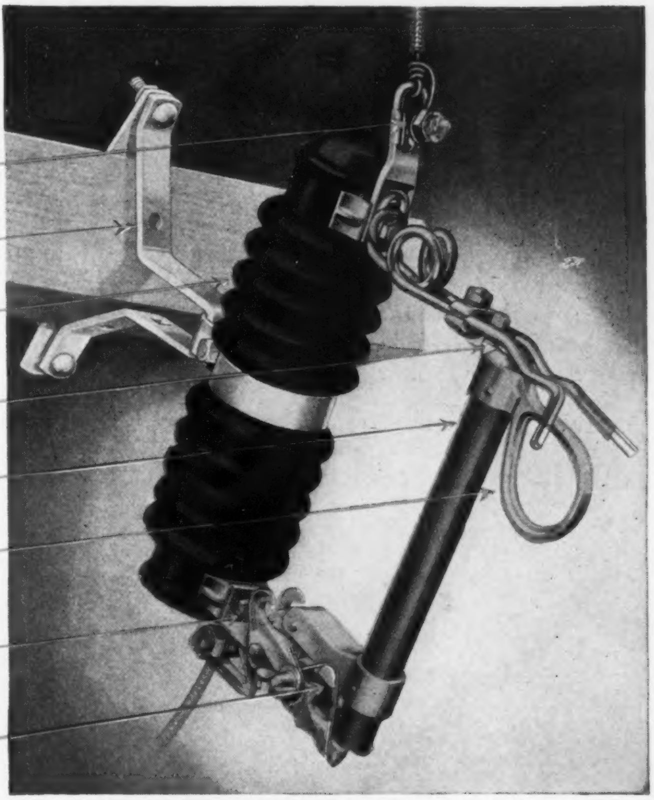
LARGE PULLING EYE—for inserting a switch hook or fuse puller.

●

LIFTING HOOKS—facilitate easy removal and installation of cartridges with a switch stick.... Tripping Mechanism—is made of corrosive-resistant material.

●

SNUBBING BLOCK—serves to mechanically relieve the tension on links smaller than 25-ampere size.



SWITCH RATINGS

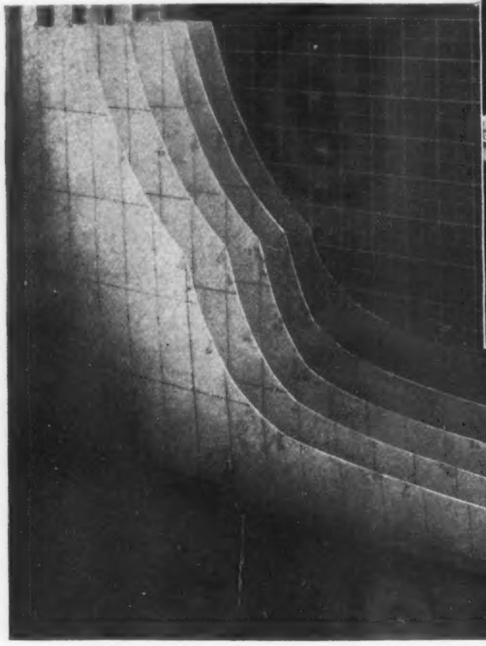
Voltages	Amps.	Cat. No.
5,000	100 OR LESS	6400
7,500/12,500YGrd.		6401
15,000		6402

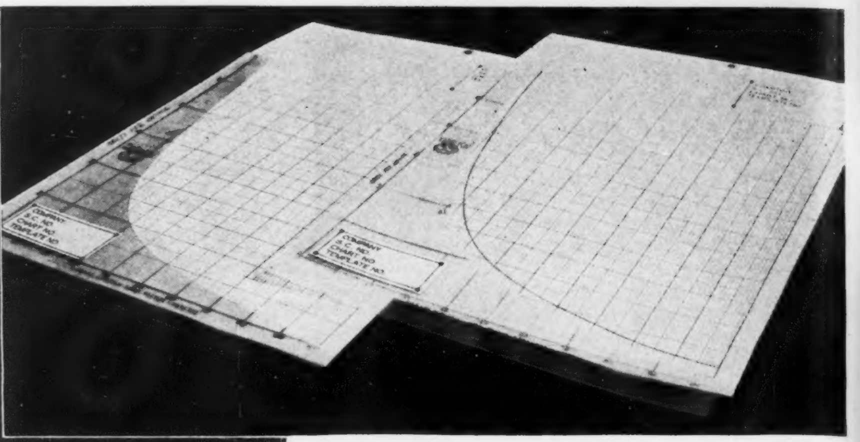
SOLDERLESS CON-NEC-TITES;
T-CON-NEC-TITES;
LAP-TITE CONNECTORS;
TRIP OUT FUSE SWITCHES;
TRIP-O-LINK FUSE SWITCHES;
TRIP-SAVER FUSE SWITCHES;
ONE AND TWO INSULATOR FUSE AND DISCONNECT SWITCHES;
PORCELAIN HOUSED TRIPOMATIC FUSE CUTOUTS;
DOUBLE DUTY FUSE CUTOUTS;
POLE TOP GANG OPERATED SWITCHES;
PORCELAIN HOUSED DISCONNECT SWITCHES;
N. E. M. A. HOOK OPERATED DISCONNECT SWITCHES;
FUSE LINKS;
FUSE LINK BOXES;
FUSE PULLERS;
SECONDARY FUSES;
SCREW ANCHORS;
EXPANSION ANCHORS;
FULL-VU GUY GUARDS;
GUY WIRE CLIPS AND STRAND BANDS;
ECONOMY CABLE CLAMPS;
DEAD-END SERVICE CLAMPS;
V-GROOVE SERVICE CLAMPS;
HITEMETERS;
"J" HOOKS;
CONDUIT STRAPS;
ABC SLEEVES AND MACHINES;
CABLE RING SADDLES;
FIT-RITE WIRE HOLDERS;
SLEEVE TWISTERS;
GROUND WIRE CLIPS;
GROUND CLAMP-TITES;
GROUNDING CABLE;
HI LINE TOOLS AND ACCESSORIES;
CON-NEC-TAP CLAMPS;
GROUNDING SETS;
MASTERENCHES

KEARNEY PRODUCTS

Designed and Manufactured by **JAMES R. KEARNEY CORPORATION**
4236 CLAYTON AVE., ST. LOUIS, MO.
FACTORIES AT ST. LOUIS, MO., TORONTO, CANADA

Templates may be used for rate comparisons without reproducing curves on paper





Templates representing various rate curves simplify rate comparisons by making it possible to reproduce the same curve many times without plotting points

drawn for purposes of comparison.

All of these templates use a scale representing the cost of power in cents per kw.-hr. on the vertical axis or ordinate. On the horizontal axis or abscissa one of three variables, kw.-hr. use, kw. demand or per cent load factor, is represented. Four combinations of these variables are most frequently used in making rate studies: With load factor constant and the ordinate cents per kw.-hr. the abscissa may be (1) kw.-hr. use or (2) kw. demand, and with demand constant the abscissa may be (3) load factor in per cent or (4) kw.-hr. use. All four of these "type curves" are not necessary for any one schedule. If curves (1) and (3) are represented it often happens that (2) and (4) may be omitted, and *vice versa.*

Before making the templates, chart paper and scales were standardized and a careful selection of values for both the constant and varible factors was made in order to limit the number of curves represented by templates. All templates were made from two sizes of chart paper with ten divisions to the inch both ways. Thus the use of two different size sheets afforded a choice of a sheet 11 x 17 in. or 8½ x 11 in. The latter was found useful when average cents per kw.-hr. was plotted against per cent load factor and the former when plots were made against kw.-hr. per month.

For the first type of curve where kw.-hr. use was plotted against cost for constant values of load factor, six ranges were adopted for the kw.-hr. per month scale.

(1) 0–100, (2) 0–1,000, (3) 0–10,000, (4) 0–100,000, (5) 0–1,000,000 and (6) 0–10,000,000.

This curve was made on a 11 x 17-in. sheet with the kw.-hr./mo. scale on the 17-in. side. In each case the first 5 in. covered 1/10 of the scale range, the remaining 9/10 was covered on the next 9 in. Each scale range required its own template for a given rate.

The second type of curve, that of cost vs. kilowatt demand for constant values of kw.-hr. use, was omitted since the first curve covers cases most commonly encountered.

Type three curves, cost vs. per cent load factor for constant demand, have one inch of the abscissa equal to 10 per cent load factor, thus enabling the 100 per cent range to be shown on the 11-in. side of the 11 x 17 sheet. In this way the template could be used to reproduce a curve on an 8½ x 11-in. sheet if properly fitted.

Since templates of type three curves were made, those for type four were not immediately required and were thus ommitted from the schedule temporarily. In all templates made the average cost scale was standardized at 2 in. equals 1 cent.

In constructing the templates 20 x 50-in. sheets of "Plastacele" were used. The curve from which the template was to be made was carefully drawn on chart paper on which standard scales have been laid out. Over this the Plastacele is laid, the axis laid out and the curve cut out of the sheet by tracing with a sharp instrument.

Under-water Power Station

Pictures, Inc.

Within this hollow dam across the Persante River at Rostin, in Pomerania, is perhaps the world's first under-water power station. Built under the river from one embankment to the other, it houses two small turbo-generators and is attended by one man. Its total cost is said to be one-seventh of that for a station of conventional design.

A LITTLE THING ★

WELL DONE

TO WARD OFF WINDING FAILURE IN

L-M DISTRIBUTION TRANSFORMERS

L-M Coil Winders place double layers of insulation both above and below transformer tap leads. The result is more resistance to lightning surges, less danger of winding failure. This is one of the many "little things well done" to make sure that L-M Transformers will give you extra years of trouble-free service. Get full details. Write to South Milwaukee, Wisconsin, for L-M Transformer Bulletin, LMB 6364.

LINE MATERIAL CO.

Building Up THE LOAD

New ideas and practices in selling electrical equipment and service to commercial and domestic customers

Contactor Limits Small Power Demands

By **E. F. HOCKENBEAMER**

Coast Counties Gas & Electric Company
Santa Cruz, Calif.

Incorporated in the General Power Service Schedule (P-1) of the Coast Counties Gas & Electric Company is the following paragraph:

> Where the installation consists of two or more three-phase motors the customer may select any standard motor rating between 7½ hp. and 40 hp. inclusive, but not less than the largest motor installed, which will then become the customer's connected load for the purpose of this schedule, and the company will at the consumer's expense install a suitable load-limiting device which will prevent the use of loads exceeding the predetermined amount.

The load-limiting device mentioned above is a Westinghouse Deïon line-starter with some minor modification of the relay resetting device. This switch is placed in series with the customer's main disconnect switch and the load, the horsepower demand rating being governed by the current rating of the heater elements installed on the thermal overload relay.

After the switch is installed the heater sizes are checked, the overload relay adjusted to current values as tabulated and the switch sealed closed with a meter seal. When the load exceeds the amount for which the switch is set the overload relay opens the magnetic contactor and closes down the load. Resetting may be either automatic or manually controlled.

This arrangement is suitable for small power accounts where short interruptions are unimportant, although by proper selection of thermal elements this can be minimized. It allows this class of consumer to be billed on actual demand with a predetermined maximum rather than on connected load. There is no penalty for having individually motored equipment in the small shop. Where this is used by a growing business, increased demand is taken care of by merely changing the heater elements on the overload relay. Where the load increases beyond the capacity of this switch (125 amp.) and the account becomes large enough to warrant a demand meter the switch may be salvaged as a motor starter. The addition of a start and stop push-button station also allows the switch to be used to disconnect shop power.

The approximate cost of this switch and its installation is $60. Where a power account has a minimum bill in excess of actual energy charges savings effected will normally pay its entire cost within a short time.

•

Appliance Servicing Becoming a Big Job*

Intensive load-building activities of the past few years have greatly increased the obligation of service problems. In general, a town of one thousand people will require a certain number of service calls. Double the number of customers and the calls

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* From 1936 report of Service Operations Committee, Wisconsin Utilities Association.

Direct Action Fills Sockets

SIX
60
WATT
EDISON
MAZDA
LAMPS
90¢
NO MONEY DOWN

Sales crews of the Missoula Division of the Montana Power Company went to market with white baskets filled with the wares they had to sell. Each man carried an assortment of lamps from which deliveries could be made on the spot. Uniformed with neat white aprons, carrying their merchandise right to the prospect's door and armed with a 90-day credit plan by which the purchaser could pay for six lamps at 30 cents a month added to his electric bill, the sales crews had no difficulty in filling the empty sockets in the division.

ALERT!

In every nerve and sinew, the skillful fencer is alert. It would be boasting for us to say that we, too, are alert. It is a fact, however, that our company is not so large as to be ponderous—its size permits a flexibility that is very useful to a customer who is in a big rush for his heating element alloy—a flexibility that allows a nimble change of pace and direction in our program of endless research over a stretch of 30 years, continually improving Chromel. This is not told as an attribute to us, but is presented to you as further justification for your confidence in heating elements made of Chromel. . . . If you are interested in heating unit design, you will find useful information in Catalog "K". . . . Hoskins Manufacturing Company, Detroit, Michigan.

HOSKINS

CHROMEL

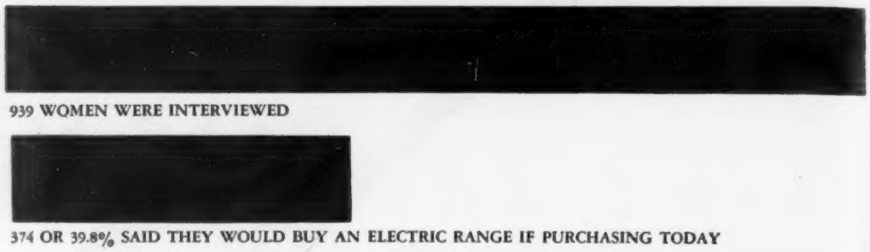
THE WIRE THAT MADE
ELECTRIC HEAT POSSIBLE

will practically double. The same parallel applies with electric ranges, refrigerators and nearly all other major appliances, and many of the minor ones as well. The point is ultimately reached where a force of a given size cannot adequately provide the required service.

The service man's duties start where the salesman's duties end. Whether we like it or not, the service man's task is becoming more and more complex each year. Consideration of this problem has already been given by some companies, with the result that the personnel of the service departments is being increased, or, in the case of companies supplying dual services, men are being trained in the duties of both gas and electric servicing.

Ten years ago, when there were few refrigerators and like complex appliances, there was little need for highly trained service men. Such is not the case today, for we must have men available at all times who are thoroughly competent to service the machines which we sell. In the thickly populated centers a staff of specialists in each line of service work is probably most satisfactory. However, in the rural areas, where one service man may cover an area as large as 25 miles in radius, the specialist obviously becomes impractical and uneconomical. The logical solution here seems to be to train one or two individuals in all service operations. One employee may not be able to perform some of the more complex servicing tasks, but he should be able to handle a large part of them, and as necessary, secure the services of a specialist from one of the urban centers.

Preference Grows for Electric Ranges



Individual investigators in eleven cities asked 939 housewives, "What kind of a range do you plan to buy next?" among other questions. Preference for electric ranges varied from 22 per cent in Indianapolis to 100 per cent in Medford, Ore., and Salt Lake City, but averaged 40 per cent nationally, compared with 29 per cent in 1935. Survey was reported in a publication of the Edison General Electric Appliance Company, Chicago, Ill.

●

Off-the-Case Lighting for Candy Showcases

By L. I. WHITCHURCH

Assistant Supervisor Lighting Sales
Commonwealth Edison Company, Chicago

Nothing less calculated to stir the buying urge can be imagined than a chocolate cream that has not been able to stand the heat. Yet with its rich brown patina glowing in plenty of light this same chocolate cream will make even a diabetic envious and cause purses to open of themselves. The truth of these two observations is thoroughly appreciated by up-to-date candy store operators and they have sought means by which their goods may be shown under lots of light and not, at the same time, be melted down.

One way, and the obvious way, to take the heat out of the candy showcase is to take the lamps out and to supply even, bright light on the goods for sale as is shown in the accompanying illustration. In this installation the two case-lighting units each contains ten 50-watt lamps above a ground glass panel. General illumination is provided by four 500-watt lamps in indirect fixtures. There is thus a lighting load of 3 kw. in the interior of this small store. This installation, in one of the shops of "Joy Candies," a Chicago chain, was made according to a layout furnished by the lighting engineers of the Commonwealth Edison Company.

Light, but no heat, on candy in these cases

●

Kitchen Heating Plan Aimed at Range Users

Convinced that the electric range user also is a potential customer for electric heat in the kitchen during the winter months, the Pacific Gas & Electric Company is offering a special sales proposition to the electric range users on its line. The offer consists of a 3-kw. Wesix circulating air heater with built-in automatic thermostatic protection which is connected to the electric range through a 20-amp. porcelain plug and fuse connection.

Installation is free and the combination is sold for $29.95 on terms as low as $3 a month. The announcement of the offer was mailed on a double card, one portion of which could be detached into a postpaid request for additional details. Cleanliness, convenience and low operating cost for the electric heat were stressed, the latter point being possible because the heater and range combination brings the user into the lowest block of local electric rate.

RESEARCH ... PROGRESS ... OBSOLESENCE

The Eternal Cycle

For more than 33 years Century has helped manufacturers reach higher levels in development, production, sales and profits—by keeping pace with the eternal cycle of Research, Progress and Obsolesence.

Research—a combination of massed experience and vision—is responsible for the ability of Century Polyphase Motors to start quietly and run quietly with remarkable freedom from vibration.

Developed particularly for Freon gas refrigerating machines—extensively used in Air Conditioning—Century Motors have the high starting torque necessary to eliminate the extra cost of over-motoring.

Benefit by Century's massed experience—it has contributed substantially to the advanced development and economic progress of American industry.

CENTURY'S CONTRIBUTION TO INDUSTRY

In many instances where the development of new machinery and new appliances brought newer and greater motor demands, Century has been the only available motor already perfected to meet the job requirements.

CENTURY ELECTRIC COMPANY

1806 Pine Street St. Louis, Mo.
Offices and Stock Points in Principal Cities

Century
MOTORS

SIZES UP TO 600 HORSE POWER

News ABOUT PEOPLE

Utility Management Names J. S. Avery Vice-President

J. S. Avery, who was recently named a vice-president of the Utility Management Corporation with headquarters in New York, has had extensive operating experience with utilities in the East and South.

A native of Rochester, N. Y., and a graduate of Cornell University, Mr. Avery was connected with properties in the southeastern part of New York early in his career. Before his affiliation with the Virginia Public Service Company, of which he was president at the time of his recent appointment, he was general manager of the Metropolitan Edison Company, Reading, Pa., and of the New Jersey Power & Light Company, Dover, an affiliated company, and more recently served as vice-president and general manager of the Utica Gas & Electric Company, Utica, N. Y.

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►L. S. **Boggs**, service engineer, Westinghouse Electric & Manufacturing Company, East Pittsburgh, has retired from active service. Mr. Boggs has been associated with the Westinghouse company since 1904, having started as a construction engineer. He took an active part in many major railway electrification projects, both in the United States and South America.

•

Executive Shifts Announced in Southern Properties

Announcement has been made of several changes in executive personnel in southern properties of the Associated Gas & Electric System.

Alex Speer, who has been president of the Florida Power Corporation for the past eight years, has been elected president of Virginia Public Service Company with headquarters at Alexandria, Va., to succeed J. S. Avery, who is moving to New York as a vice-president of the Utility Management Corporation.

Mr. Speer will have associated with him in Virginia Frank A. Mitchell, as vice-president and general manager of Virginia Public Service. Mr. Speer's new duties in Alexandria are somewhat in the nature of a homecoming, for he not only returns to the properties with which he was associated before his Florida experience, but to the state of his birth. During his association with Florida Power he has been an enthusiastic sponsor of rural electrification.

Underwood & Underwood

Alex Speer

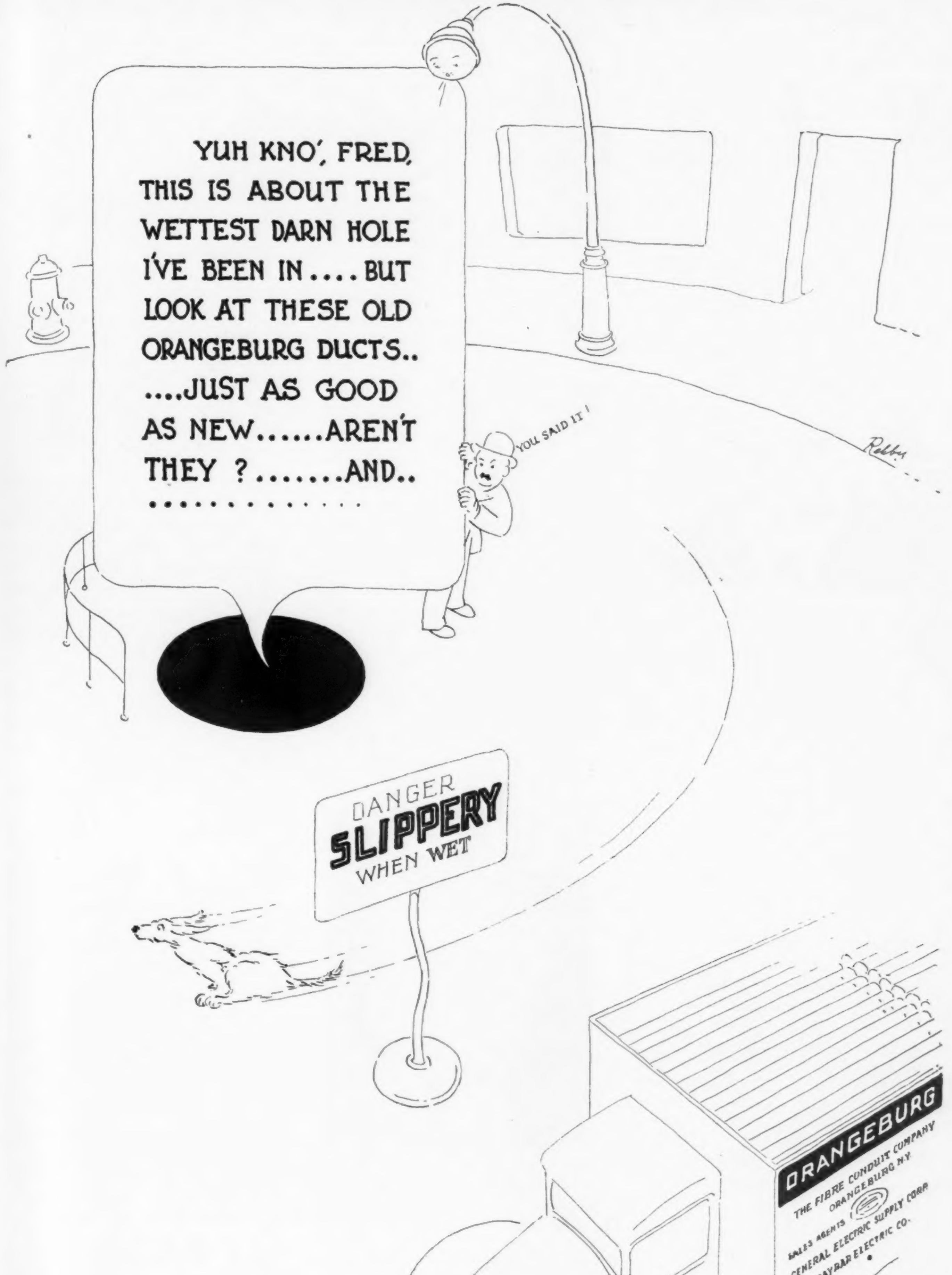
F. A. Mitchell

Mr. Mitchell goes to Virginia Public Service Company with more than 23 years' experience in various accounting, operating and management phases of the utility industry. He has been identified with the Eastern Shore Public Service Company, Salisbury, Md., since 1913 and for some time has served in the capacity of vice-president and general manager.

Albert W. Higgins, a vice-president of the Utility Management Corporation, New York, has been elected president of the Florida Power Corporation, succeeding Mr. Speer, and Lewis Payne, formerly vice-president of Virginia Public Service Company, has been elected president of the Eastern Shore Public Service Company.

•

► A. C. **Bull**, Public Utility Engineering & Service Corporation, has been elected chairman of the public utility group of the National Association of


YUH KNO', FRED, THIS IS ABOUT THE WETTEST DARN HOLE I'VE BEEN IN.... BUT LOOK AT THESE OLD ORANGEBURG DUCTS.. ....JUST AS GOOD AS NEW......AREN'T THEY ?.......AND.. ....
YOU SAID IT!
Robbs
DANGER SLIPPERY WHEN WET
ORANGEBURG
THE FIBRE CONDUIT COMPANY ORANGEBURG N.Y.
SALES AGENTS
GENERAL ELECTRIC SUPPLY CORP.
GRAYBAR ELECTRIC CO.

Purchasing Agents. **Sumner Keyes**, Edison Electric Illuminating Company of Boston, has been elected secretary and treasurer.

•

H. M. Williams Elected Head of Refrigeration Engineers

Harry M. Williams, manager of the standards division of Frigidaire division, General Motors Corporation, was elected president of the American Society of Refrigeration Engineers at the recent annual meeting in New York City.

Mr. Williams has been an active engineer and manufacturing executive for many years. His work with Frigidaire has been as a chemical engineer, manager of the commercial refrigeration engineering division and as manager of the standards division, the position he now holds. Mr. Williams is chairman of the technical committee of the refrigeration division of the National Electrical Manufacturers Association.

•

►**Harry P. J. Steinmetz**, general sales manager of the Public Service Electric & Gas Company, Newark, N. J., is at present recuperating in Florida. Mr. Steinmetz became ill in December. He is expected to return to his office in a few weeks.

►**William H. Taylor**, president of the Philadelphia Electric Company, has been elected a member of the board of directors of the United Gas Improvement Company.

►**F. M. Farmer**, vice-president and chief engineer of the Electrical Testing Laboratories, Inc., New York, N. Y., has been elected chairman of the standards council of the American Standards Association for the year 1937. Mr. Farmer has been active in various phases of A.S.A. work.

►**D. J. DeBoer**, formerly assistant electrical engineer, Sargent & Lundy, Inc., Chicago, Ill., recently was appointed chief electrical engineer of the Loup River Public Power District, Columbus, Neb.

•

E. A. West Assumes Duties With Florida Power & Light

Edward A. West, who recently was elected vice-president and general manager of the Florida Power & Light Company, Miami, had served as vice-president and general manager of the Utah Light & Traction Company, Salt Lake City, since 1925. He is well known in the public utility field.

A Canadian by birth, Mr. West was educated at Tufts College and at the Massachusetts Institute of Technology. He has been connected with the Boston Elevated Railway, Schumacher & Santry, Boston, consulting engineers, and the Portland Railway, Light & Power Company, Portland, Ore.

His duties as efficiency engineer of the Portland properties took him into all departments and activities of the company. He inaugurated many changes in departmental relations, introduced cost and planning methods, a perpetual inventory system, for recording property, valuation data, and made a detailed study of the integral parts of the company organization. From Portland he went to the Denver Tramway, Denver, Colo., first as chief engineer and then as general superintendent, the position he held until his appointment in Salt Lake City.

►**Stanley W. Canniff** has been appointed general manager of the Ottawa Hydro-Electric Commission to succeed John E. Brown, who resigned after 30 years of service. Mr. Brown will act in an advisory capacity for one year. Mr. Canniff has been assistant general manager for more than twenty years.

OBITUARY

►**Nathaniel E. Brooks**, who had been connected with the Kerite Insulated Wire & Cable Company, Inc., since 1929, died in New York January 23, after an illness of several months. Mr. Brooks was a graduate of the Massachusetts Institute of Technology.

►**Merrill C. Morrow**, sales manager of the Pennsylvania Power & Light Company, Allentown, and formerly sales manager of the merchandising department of the Westinghouse Electric & Manufacturing Company, died in Philadelphia February 22. In the course of his long association with the electrical industry Mr. Morrow contributed much to the solution of manufacturers' merchandising problems.

►**Robert W. Gotshall**, general sales representative for Caterpillar Tractor Company, Peoria, Ill., and a pioneer in the development of the track-type tractor, died February 11, in his fifty-fifth year. Possessing both the attributes of sales executive and technical engineer, Mr. Gotshall, became an active leader in road machinery industries.

►**Fred L. Hough**, formerly design engineer in the mechanical engineering department of the Brooklyn Edison Company, died January 29 in Dunedin, Fla. When Mr. Hough retired, in 1935, he had been with the Brooklyn Edison Company for almost 23 years, except for a period of five months during which he was with the New York Edison Company. Mr. Hough was 54 years of age.

►**Gregory K. Ordjonikidze**, commissar of heavy industry and one of the most influential leaders of the Soviet Government, died February 18 in Moscow, in his fifty-first year. A great admirer of American technique and efficiency, Mr. Ordjonikidze was largely responsible for building and operating the hydro-electric stations, blast furnaces and factories which are transforming Russia into an industrial nation.

"IT'S ALWAYS FAIR WEATHER"

. . . so far as HI-VOLTAGE is concerned

● Other air-break switches give dependable service under most conditions but only HI-VOLTAGE can go the whole distance. • • • Dependable service under *any* weather conditions—for a practically unlimited period of time—*is assured by:*

1. **Totally enclosed, all-bronze, accurately machined, operating mechanism.**
2. **Monel Ball Bearings.**
3. **Graphite-Insert Bearings.**

Bulletin 26 gives all the information you need to select the proper type and size for any particular requirement

•

TYPE C-W
46 K-V TO
69 K-V AIR
BREAK SWITCH

•

Write for
Bulletin
No. 26

•

HI-VOLTAGE EQUIPMENT CO.

2891 EAST 79TH STREET • CLEVELAND, OHIO

Manufacturing AND MARKETS

Appliance Peak Far Away, States Allen

In discussing merchandising problems in the electrical appliance industry before the Sales Executives Club of New York, Inc., at the Hotel Roosevelt last week, A. E. Allen, vice-president of the Westinghouse Electric & Manufacturing Company, asserted that, despite "high saturation" in this market, the electrical industry still has a long way to go before it reaches its sales peak.

Mr. Allen said that public utilities pioneered the introduction of practically all electrical appliances from the early electric iron to the present electric range and water heater. Detailing the appliance industry's growth in the last ten years, he pointed out that in 1927 sales of electrical merchandise amounted to $841,223,440, whereas last year the retail value of merchandise sold was $1,411,330,783.

"So even with high saturations," Mr. Allen said, "the replacement market and new converts appear to keep the sales up year after year. With approximately 22,000,000 wired homes in this country the rapidly growing consciousness of and demand for 'a more abundant life' and the realization that electrical appliances largely contribute to this end, we in the electrical industry feel that we still have before us a very bright future."

•

General Electric Designs Lights for Illinois City

The lighting system of the entire business section of Dixon, Ill., will be modernized, according to General Electric Company, which is designing the new system. Installation will be made by Illinois Northern Utilities Company.

Units now in service will be replaced by 134 luminaires which will be equipped with 4,000-lumen incandescent lamps mounted on fluted heavy-duty poles spaced 100 ft. apart on both sides of the street.

•

Opens New Branch

The Graybar Electric Company has opened its eightieth branch house at Allentown, Pa. The house will be operated as a branch of Philadelphia, with W. L. Hall as manager, W. H. Naudascher as service supervisor and G. F. Brady as merchandise manager.

•

New Line for Tips Tool

Completing its line of equipment and tools for safe working on live lines, the Tips Tool Company, Taylorville, Ill., has recently begun to sell linemen's rubber protective equipment. Rubber gloves, sleeves and blankets with protector coverings and carrying bags comprise the new line.

Kelvinator Shipments Show Sharp Increase

An increase of 114.4 per cent in total January shipments of Kelvinator refrigeration products over a year ago was announced by H. W. Burritt, vice-president in charge of sales. Unit shipments for the month totaled 37,759, as against 17,609 a year ago.

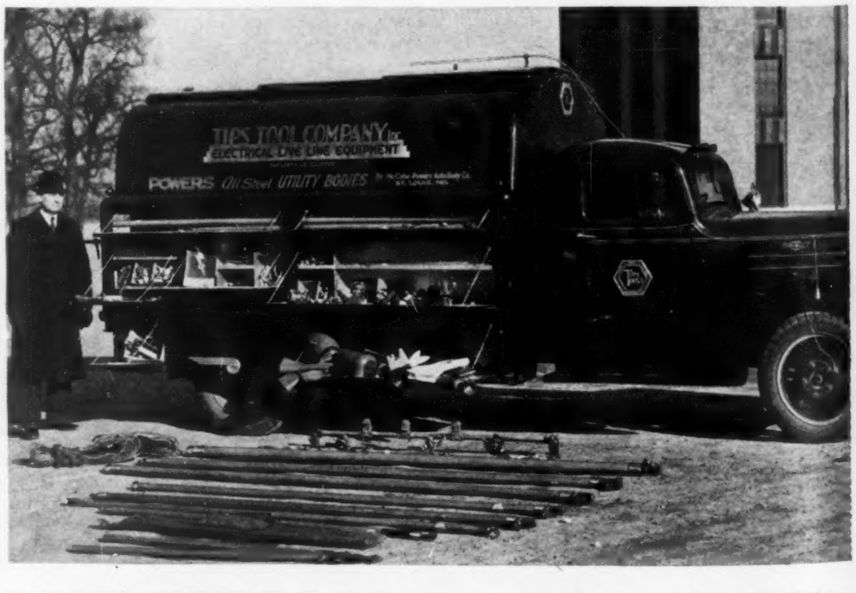
Total shipments for the first four months of the fiscal year beginning October 1 increased 55.1 per cent over the same period in the preceding fiscal year. Unit shipments were 91,366, against 58,879.

January shipments of domestic refrigerators in January showed an increase of 85.5 per cent over a year ago.

•

Norge January Sales Up

Sales of the Norge division of the Borg-Warner Corporation totaled 43,065 units last month, an increase of


TIPS TOOL COMPANY INC.
ELECTRICAL LIVE LINE EQUIPMENT
POWERS Oil Steel UTILITY BODIES

LIVE LINE EQUIPMENT—K. H. Best, factory representative of Tips Tool Company, has traveled about 40,000 miles in the past year demonstrating the technique of live line maintenance, safety grounding devices and other equipment

Burroughs

4 PAYROLL RECORDS in 1 WRITING

COMPLETE SOCIAL SECURITY RECORDS at a LOWER COST

1 THE PAYROLL

The complete payroll and check register in one unit shows the gross pay, all deductions, and the net pay for all employees. Separate totals for all columns accumulate automatically.

2 EARNINGS RECORD

Complete individual progressive record for each employee shows time worked, gross earnings, deductions, and net pay for any and all periods. Provides information needed for old age benefits, unemployment insurance, and income tax reports.

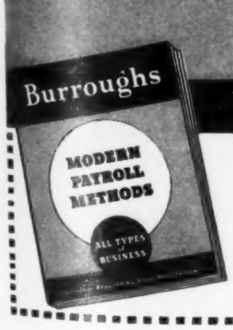
3 EMPLOYEE'S STATEMENT

This receipt for deductions, which the law requires be given to each employee at each pay period, also shows the individual's gross earnings, all deductions, and net pay. It can be retained permanently by the employee.

4 PAY CHECK or pay envelope

Since the check or pay envelope is written with the above three records, the amount is in perfect accord with these records.

These four payroll records can be produced as one fast job on any one of the many new payroll machines Burroughs provides especially for this work. Regardless of the size of your payroll, or the nature of your payroll handling problem—these new machines can bring to you the substantial savings in time and money they are bringing to many concerns in all lines of business. It will pay you to investigate. For quick action, telephone your local Burroughs office or wire direct today. Or mail the coupon.



SEND FOR THIS NEW PAYROLL FOLDER!

BURROUGHS ADDING MACHINE COMPANY, 6452 SECOND BLVD., DETROIT, MICH.
Send me the new folder "Modern Payroll Methods"—which includes illustrations of forms for compiling figures required by the Social Security Act.

Name____________________Type of Business________________

Address____________________________________

47.6 per cent over sales in January, 1936, Howard E. Blood, president, has announced. The following percentage gains were made over a year ago: Refrigerators, 75.9; washers, 37.8; ironers, 173.5; commercial refrigeration, 107.6; kitchen ranges, 21.9; oil burners, 121, and furnaces, 361.5.

•

Carrier Corporation Makes Huge Air Unit Installation

The world's largest hospital air-conditioning installation has been made by the Carrier Corporation of Newark, N. J., in the 200-room hospital of the National Railways in Mexico City. The ultra-modern building is the first completely air-conditioned hospital in the world. Two central station air-conditioning units were installed to service every space in the building occupied by patients and employees. This includes the operating rooms, private wards and public reception rooms. Another recent Carrier hospital installation was in the Loma Linda Sanitarium at Loma Linda, Calif.

•

Air-Conditioned Railroads

A total of 8,078 air-conditioned passenger cars, including 4,152 owned by the Pullman Company, were in operation on railroads in the United States January 1, according to the Association of American Railroads. Since last April more than 1,300 cars have been equipped with air-conditioning devices.

•

Rise in Metal Prices

Metal prices during the past week soared to new highs on the present move, with electrolytic copper hitting a range of 14-15 cents a pound. Lead was up ½ cent a pound, while spot zinc rose sharply to 7.15 cents. European markets were the scene of frenzied buying and a sudden rise in prices of metals.

New York Metal Prices

	Feb. 17, 1937 Cents per Pound	Feb. 23, 1937 Cents per Pound
Copper electrolytic......	14.00*	14-15*
Lead Am. S. & R. price.	6.00	6.50
Antimony...............	14.25	14.25
Nickel ingot.............	35.00	35.00
Zinc spot................	6.75	7.15
Tin Straits..............	51.50	55.00
Aluminum, 99 per cent..	19—20	19—20

* Delivered Connecticut Valley

Field Reports on Business

General business is holding up remarkably well. Retail and wholesale trade show further gains. Reports from the field to Electrical World *indicate that substantial orders are being received for diversified electrical equipment. Power apparatus is moving at a good pace and industrial lighting equipment sales are steadily increasing. Domestic appliances are exceptionally active for this season.*

PACIFIC COAST

The beginning of actual work on several large projects, the release of strike-bound shipments and heavy utility buying of copper wire, such as one cumulative order of a million pounds because of price advances, have all stimulated coast business in various aspects, but now there is hesitation over releasing new work because of a certain uneasiness over various prevailing trends. However, the Salt Lake City area is exceedingly busy in all branches, especially in housing construction, and Idaho utilities have the largest proportionate construction program in the country.

Apparatus manufacturers report their coast plants are working to capacity. There are no spectacular orders, though the general run of motors, meters and distributing transformers are moving briskly. Spokane district is planning 50 miles of rural electrification and southeastern Oregon 60 miles, each averaging $1,000 per mile on government grant.

California's Central Valley project, designed to equalize the heavier rainfall in the Sacramento Valley with the heavier demand in the San Joaquin Valley, has been placed on the A or rush list for government consideration.

Lighting lines are exceedingly active, especially in public work, including an 80-standard street-lighting job for Los Angeles, several smaller jobs averaging $5,000 each to link various bridge approach areas in San Francisco, and an initial $100,000 appropriation now before the Legislature to equip 40 miles of major highway south of San Francisco with sodium light standards.

NEW ENGLAND

Electrical trade continues to feature diversified consumption of materials and vigorous interest in lighting and power apparatus. The United Electric Light Company, Springfield, announced a $604,000 construction budget at its annual meeting a few days ago, and this will include elimination of arc lamps in the north end of the city, completing a program of replacement with incandescents on all public thoroughfares. Industrial lighting equipment sales are increasing steadily, notably in the novelty jewelry trade, in the chemical manufacturing field and textile industry. Interest in power-factor correction in factories has taken a new lease of life and the sale of static condensers for distributed locations has been quite good of late. Machine tool builders continue to absorb large quantities of motors for individual drive, but there is also an undercurrent of interest in the economics of group driving which has led lately to the purchase of several motors for this type of service in various industries.

Domestic appliances are moving exceptionally well for this season. Contracts for 1022 Hotpoint ranges and 1022 Westinghouse refrigerators have been placed for the Old Harbor Village Federal Housing Project in Boston. The Boston Edison Company's co-operative efforts to establish wider use of planned electric kitchens are bearing fruit. Already this year appliance sales in New Hampshire and Vermont are running 15 to 20 per cent ahead of a year ago, and special moves are now being planned in these states on the potential consumer market for electric water heating on the basis of off-peak rate inducements and more intensive merchandising. Rural applications of electric service are being actively pushed in all parts of New England by privately owner utilities.

General business holds up remarkably well and activity in wiring projects for institutional service is increasing. Wholesalers of electrical material are doing a land office business in many localities.

NEW YORK

With the recent increase in price of domestic copper there is some talk in trade circles that an upward adjustment is likely in wire and cable prices. Opinion has been expressed in some quarters that copper prices may be put up another notch in the not-too-distant future. The upward trend has stimulated forward purchases. Continued unseasonal warm weather for this section has enabled construction to move ahead with the prospects of increased activity before spring. Rural line construction and additions to utility plants appear of major consideration at this time. Department stores and other retail outlets report good buying of household electrical appliances. Sales campaigns on water heaters, ranges and refrigerators are being stimulated. Reports indicate a banner year in appliance sales.

CHICAGO

General business activity in this district made moderate advances during the past week. A number of industrials added to their payrolls as production increased. Retail and wholesale trade showed further gains. Freight traffic moved higher and five Western railroads announced the purchase of additional equipment, including eight streamlined locomotives, ten light-weight coaches and 1,500 steel box cars. Electric energy output in the Chicago area declined 3 per cent, but remained 9 per cent higher than a year ago.

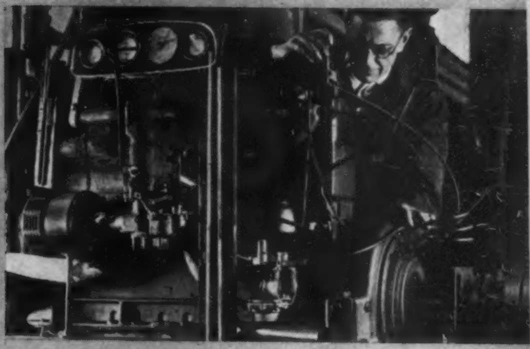
Substantial orders for diversified electrical equipment are still being received from the Middle West flood areas, where rehabilitation is progressing rapidly. Motor sales are steady—installation of 419 fractional-hp. and 27 of 50 hp. or larger reported this week. Contractors' activity is progressing, 741 convenience outlets and 3,679 light outlets reported over a three-day period. Sixteen outdoor and 91 indoor signs were installed. Small transformers and rectifiers are in steady demand. Manufacturers report sales of 513 cabinets and panelboards last week. Electric welders are moving steadily. New sound equipment is being installed in six theaters. The city department of electricity is purchasing 60,000 disk films and 3,000 lampholders.

SO THAT MACHINES MAY LAST LONGER • PERFORM BETTER • OPERATE MORE ECONOMICALLY

100 times as severe as actual service in a Steam Turbine

How can better lubricants be made for the great steam turbines that supply light and power for the nation? In this apparatus, turbine oil, mixed with water, is circulated rapidly with a stream of oxygen whipped thoroughly into it. Many oils have been treated with this instrument. None has shown stability equal to Gulfcrest Oil.

How high a load can a gear tooth stand without scuffing? This instrument measures the extreme pressure characteristics of a lubricant—an important property in lubricating gears with small areas of contact and high rubbing speeds.



An 8-cylinder automotive engine on the test dynamometer to determine the wear life, horsepower output, carbon formation and friction losses due to differences in characteristics of the various lubricants used in the test.

A new machine developed by Gulf engineers—the first that will test any type of bearing under precisely the operating conditions of actual service. It measures accurately friction, torque, temperature, wear and film thickness.

GULF RESEARCH IN LUBRICATION

● Last year, the ravages of friction cost American industry more than two billion dollars. Despite the great advances made in the science of lubrication, millions of dollars must be spent each year for maintenance of industry's costly machines.

To help manufacturers save at least a part of these huge losses—that is the prime purpose of Gulf research in lubrication. Each day, in the Gulf Research Laboratories, a large staff of qualified technologists works to perfect better lubricants—to discover new methods by which oils and greases of greater endurance can be made.

Their laboratory findings—supplemented by 37 years of practical experience in lubrication—are being converted into operating benefits by Gulf engineers in scores of industrial plants. The result—to users of Gulf lubricants—is lower costs for power, maintenance and lubrication.

GULF OIL CORPORATION · GULF INDUSTRIAL LUBRICATION · **GULF REFINING COMPANY**

New EQUIPMENT AVAILABLE

Unit Air Conditioner

A complete air conditioning job, including cooling and dehumidifying, heating and humidifying and cleaning and air circulation, is accomplished by these units. Manufacturer states that these units are built on field-tested standardized designs. Each element is a complete and separable section in a compact cabinet. One section contains the complete fan assembly with motor, another the complete coil and humidifying assembly and a third the base and cleaning elements. All moving parts are easily accessible without dismantling the unit, it is said. Cabinet is constructed of heavy steel frames, coated inside and out with water- and sweat-proof insulation.

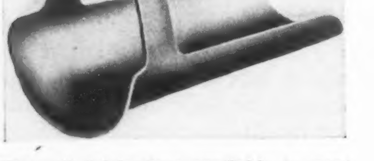
CARBONDALE

Available in sizes from 300 to 11,000 cu.ft. per minute, with refrigeration capacities from 2 to 50 tons. **Carbondale Division, Worthington Pump & Machinery Corp.**, Harrison, N. J.

●

Cable Protector

Wear on lead-covered cable at duct entrances is no longer the problem it used to be, according to reports on a fairleader developed to meet the demand for a non-corrosive and abrasion-resistant shield that moves with the cable during the latter's expansion and contraction. The standard shield is 6 in. long, of medium-hard No. 16 zinc, with a cadmium-plated bolt and nut to facilitate quick clamping to the cable. Electrolysis of the cable is warded off by the shield, it is said, and the device gets its name from its construction, being designed to prevent it from getting out of position or working out of the duct.

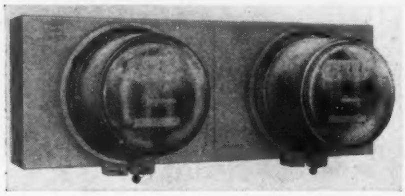


"Staput" fairleader; available in various sizes. **Wm. B. Berry Co.,** Boston, Mass.

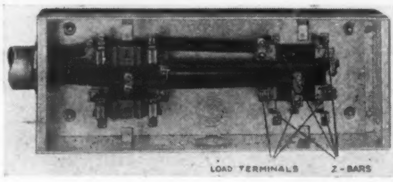
●

Meter Troughs

Standard troughs are now available which provide for the safe wiring of 4, 5, 6, 7 and 8 terminal instruments, it is said. They have been designed for single and polyphase Type S instruments. All types are provided with wiring bases having solderless terminals. Line and load wiring completed with cover socket removed. Indoor and outdoor types are available.



Type I, O, H and S standard troughs; line buses up to No. 3/0 stranded conductors, load terminals receive No. 1/0 conductors. **Palmer Electric & Manufacturing Co.,** Waltham, Mass.



●

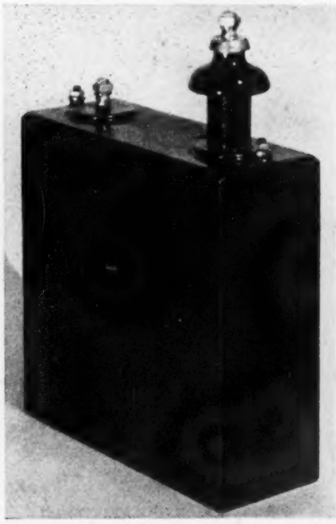
Control Unit

Type "KO"; ratings, ¾ hp., 110 to 220 volts a.c.; 1/3 hp., 115 volts d.c. **Ranco, Inc.,** Columbus, Ohio.

New stainless-steel, corrosion-proof thermostat, for general commercial use in pressure and temperature control, is said to offer distinct advantages in accuracy, capacity, dependability and adaptability. Temperature differential ranges from 4 to 20 deg.; low-pressure differential ranges from 4 to 30 lb., high-pressure differential of 30 lb. is non-adjustable. Low-pressure cutout has range of 20 to 40 lb., high-pressure 110 to 220 lb.; for temperature cutout, ranges of —15 to 20 deg., 0 to 35 deg. and 25 to 55 deg. are said to be available.

Pole-Mounted Capacitor

New type of weatherproof, steel-clad, hermetically sealed, 15-kva. capacitor unit for pole mounting on distribution circuits has been announced. Unit contains an internal discharge device and is provided with means of mounting on brackets to crossarms or directly to poles, or in groups of four on single angle iron racks, making possible inexpensive installations up to 180 kva. on one pair of crossarms, it is claimed. Capacitors may be connected with standard form of lightning arrester protection.

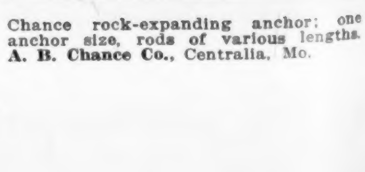


Pole-mounted capacitors; pictured is 2,300-volt, single-terminal unit, used in star-connection on grounded-neutral 4,150-volt circuit. **Westinghouse Electric & Manufacturing Co.,** East Pittsburgh, Pa.

●

Rock Anchor

This new development in rock anchors is installed by drilling a hole into the rock, dropping the anchor into the hole and turning the rod until the anchor meshes itself firmly into the rock along the side of the hole. The twisting action allows the smooth side to slip up the side of the hole and force the threaded side of the anchor to mesh into the rock. Tests have proved it to be very effective and easy to install, it is claimed.



Chance rock-expanding anchor; one anchor size, rods of various lengths. **A. B. Chance Co.,** Centralia, Mo.

REPUBLIC SILICON STEEL

Republic Silicon Steels available in six grades—field, armature, electrical, special motor, special dynamo and transformer—all described in this new book. Use your business letterhead when writing for a copy.

The shadow of slow production never haunts the assembly bench or the winding shop when cores are made of Republic Silicon Steel. Experience in scores of plants proves just the opposite.

Republic Silicon Steel makes clean, sharp punchings that lie flat, stack fast and wind easily because edges are free from burrs. Punching time is faster because there is no loose scale to clog and no hard spots to dull dies.

Now that production worries have taken the place of sales problems—consider this faster-moving-in-the-shop electrical steel. It is made in sheets and coiled strip with all coil set removed. And, because of the demand, it's a good idea to anticipate your needs.

Republic Steel Corporation

GENERAL OFFICES . . . CLEVELAND, OHIO

Circuit Breakers

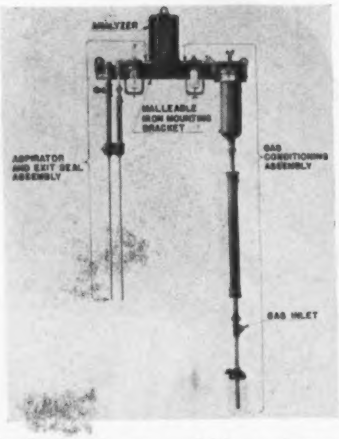
Simpler operating mechanisms, simpler internal mechanisms and fewer bearing points are features of a new line of 15,000-volt oil circuit breakers utilizing the oil-blast principle. Breaker has a horizontal break with the three poles in a single tank. Operating mechanism is built as an integral part of the breaker, whether manually or solenoid-operated. A chain and sprocket connection between the breaker mechanism and the solenoid armature makes for simplicity in the external operating mechanism.

Type FLO-1;15,000 volts, 600 amp.; three sizes, with interrupting ratings of 50,000, 100,000 and 150,000 kva. **General Electric Co.**, Schenectady, N. Y.

•

Furnace Atmosphere Analyzer

An instrument for measuring the quality of furnace atmosphere during heat treatment of metals has been developed after months of testing to determine the most important measurable factors in furnace atmospheres. Recording instrument is of the potentiometer type and is equipped with a chart 12 in. wide and divided into two equal sections so that atmosphere resulting from either complete or incomplete combustion may be measured. Analysis equipment operates on the principle of measuring the thermal conductivity of the gas mixture, continuously drawn from the furnace.



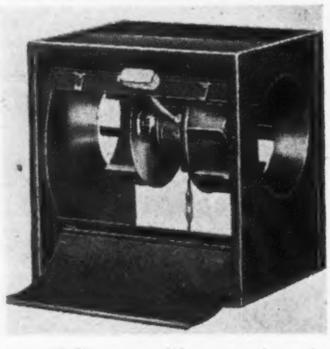
ANALYZER
MALLEABLE IRON MOUNTING BRACKET
ASPIRATOR AND EXIT SEAL ASSEMBLY
GAS CONDITIONING ASSEMBLY
GAS INLET

Analy-Graph gas analysis equipment; recording instrument not shown. **Brown Instrument Co.**, Philadelphia, Pa.

•

Skeleton-Type Blower

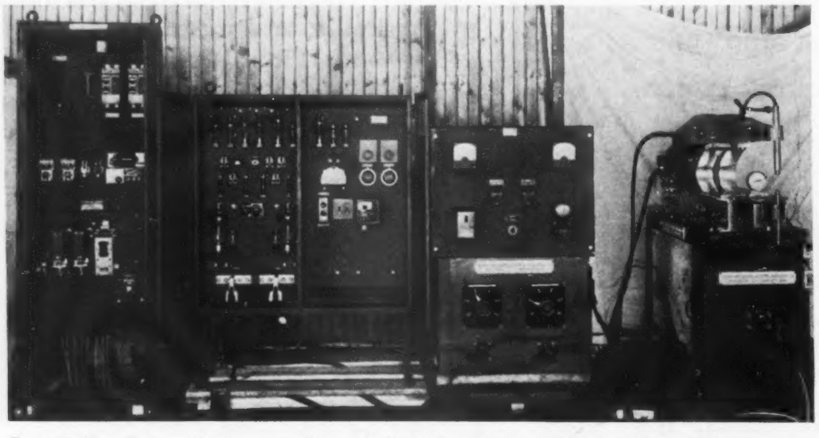
Skeleton-type blowers are available in four sizes for those who prefer to build their own blower housings. Blower wheels are mounted directly on the motor shaft and insulated with rubber to eliminate noise and provide freedom from troublesome belts and pulleys. Three types have eight-speed control units which permit selection of any three of the eight speeds; the fourth has a two-speed snap switch.



Type 17-D; capacities ranging from 1,400 to 4,950 cu.ft. per minute are available. **Emerson Electric Manufacturing Co.**, St. Louis, Mo.

Aluminum Spot Welder

One of the most interesting features of this machine for welding aluminum is the fact that it, in large part, is made of aluminum. The bell in the corner of the panel on the right, above the right-hand heat control knob, is also unusual. Its purpose is to warn the operator if the welding variables are not in the right value or sequence for the conditions under which the machine is operating. A recording device charts the value of the current flow as each weld is made so inspectors can check up on any weld that seems doubtful. Rolled copper-plate transformer secondaries and silver-plated contact surfaces are added refinements.



Spot welder for production welding of aluminum alloys; outfit includes welder proper with its main welding transformer, separate auto-transformer and two electronic control panels. **Thomson-Gibb Electric Welding Co.**, Lynn, Mass.

ENGINEERING DATA FROM MANUFACTURERS

Bulletins and catalogs now available to engineers by manufacturers and associations

Flooded Electrical Equipment—Of particular and timely interest to utilities in the flood areas should be a series of publications prepared by the General Electric Company. These publications discuss, at some length and in some detail, the restoration to service of flooded electrical equipment. Titles of the publications: "When Electrical Equipment Gets Wet," a reprint from *Factory Management and Maintenance;* "Suggestions for Drying Flooded Electric Apparatus," covering generators and exciters, transformers, induction and synchronous motors, meters, circuit breakers and other switching equipment; "Drying Out Induction Voltage Regulators," "Overhauling Lightning Arresters" and "Drying Flooded Railway Equipment." Stocks of these publications have been sent to all General Electric district and local offices in the affected areas of the Ohio and Mississippi valleys. They are available from these offices or from Schenectady, N. Y.

Factory Lighting — Benjamin Electric Manufacturing Company, Des Plaines, Ill., offers a 36-page "Manual of Factory Lighting Practice," which provides "practical solutions to 30 common lighting problems in industry." Special lighting, supplementary lighting, specialized lighting and special service installations are discussed in the publication.

Penstocks—Publication No. D15 of the Edison Electric Institute, 420 Lexington Avenue, New York, N. Y., presents data on the progress since 1923 in design and construction of penstocks, special connections and appurtenances. Report has sections on general design, types of construction, details and accessories, testing and maintenance and manufacturers' statements. Pipes of unprecedented size and for use under greater heads have been built, and the use of fusion welded pipe and specials has developed greatly during this period. Booklet is priced at $1 to members, $2.50 to nonmembers in the U. S.

Voltage Drop Curves—Kuhlman Kurrents, Vol. XIII, No. 1, published by the Kuhlman Electric Company, Bay City, Mich., contains a number of curves for determining the potential drop in single- and three-phase distribution circuits. Potential drop in volts is plotted against ampere feet. This is a typical three-phase problem that may be solved using these curves: What will be the per cent drop with reference to phase-to-phase voltage in a three-phase, 11,000-volt circuit 20,000 ft. long and carried on six-pin arms (equivalent spacing 54 in.) if the load at the end of the line is 450 kw. at 80 per cent p.f. and the conductors are three strand No. 6?

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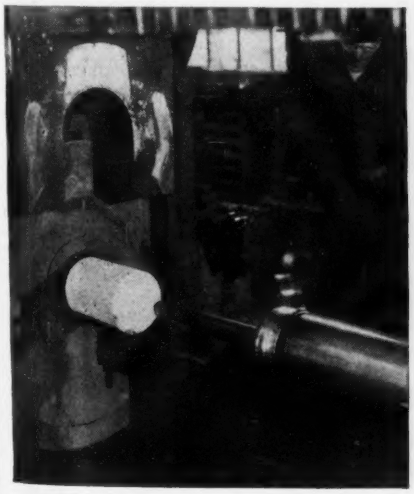

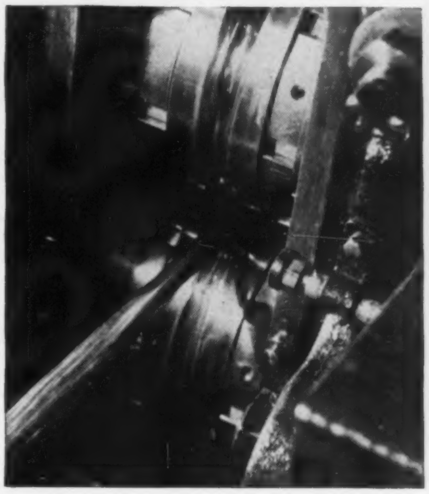

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(In rounds, flats & squares)

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Municipal Plants

Lebanon, Ind.—Acquisition of the distribution system of the Public Service Company of Indiana has been voted by a majority of citizens.

Springfield, Mass.—Plans for eventual use of the municipally owned power plant on Cobble Mountain, now leased to the Turners Falls Power & Electric Company, will be studied by a special committee of seven to be appointed under the provisions of an order of the City Council.

California, Mo.—Missouri Utilities Company has removed its light and power lines from the local streets. W. W. Harvey, district manager for the company, explained that the company had decided to contest no longer the city's suit to force removal of the lines. The city has installed a municipal light and power plant.

Wapakoneta, Ohio—City has won a two-year battle over construction of a municipal light plant when the district court of appeals handed down two opinions denying injunctions to a local taxpayer. Temporary restraining orders issued to the taxpayer were dissolved by the court and costs were charged to the plaintiff. Construction of a $104,000 power plant was approved at a general election held in 1934.

Hustisford, Wis.—This village, the first municipality in Wisconsin to ask for authority to compete with a privately owned utility and the first to be granted such authority by the State Public Service Commission, has decided not to exercise its right. Instead of taking this action it has asked for approval of the purchase by the village of the Hustisford Light, Power & Manufacturing Company for $48,500.

Fort Atkinson, Wis. — Voters have turned down a proposal that the local plant of the Wisconsin Gas & Electric Company be taken over and operated as a municipal utility. The vote was 1,650 to 428.

Camden, N. J.—For the third time in as many years bills were introduced in the state House and Senate last month to permit construction of a municipally owned electric light plant. The bills would permit borrowing of $3,300,000 from the P.W.A. plus a $2,700,000 outright grant. Residents of Camden twice voted for erection of the plant, but bills to legalize its construction were killed by the 1935 and 1936 legislatures.

●

Duke Power Suit Answered by City of High Point

One more step in the litigation arising from the decision of the High Point City Council to erect a hydro-electric plant on the Yadkin River with the aid of a federal grant in maximum amount of $2,595,000 and a municipal bond issue of $3,171,750 was taken in Greensboro, N. C., when City Attorney Grover H. Jones of High Point filed in Guilford Superior Court an answer to the complaint of the Duke Power Company as intervenor in an action against that municipality.

Among other allegations of the utility company, the city specifically denied that it is required to submit to a vote of the people the question of issuing revenue bonds for the financing of its part of the proposed plant.

●

Recent Rate Changes

Long Island Lighting Company has filed with the New York Public Service Commission a schedule of new electric rates, under which an estimated annual saving of $1,194,000 will accrue to the company's customers. The schedules conform to orders issued by the commission and recently sustained by the Appellate Division after the company had carried its objections to the courts. Two sets of schedules were filed. One was for the company's western division, comprising Nassau County and part of Suffolk County. The other was for the eastern division, which includes the eastern part of Suffolk County. In both divisions the new schedules set up a minimum monthly charge of $1 for twelve kilowatt-hours or less.

St. Joseph Railway, Light, Heat & Power Company's new rate schedules have been approved by the Missouri Public Service Commission. The new rates, effective on March 1, are expected to save electric consumers $88,144 annually.

Springfield Gas & Electric Company has filed with the Missouri Public Service Commission new electric rate schedules that are expected to save consumers $179,687 annually.

New England Power System companies will reduce rates by about $57,000 a year in March and April. Weymouth Light & Power Company will cut charges by $28,330, of which $23,560 will go to domestic customers; Spencer Gas Company will reduce rates by $5,696, and Central Massachusetts Electric Company, Palmer area, will cut its rates by $23,216. Conference with the state department of public utilities led to this action.

New Bedford Gas & Edison Light Company, New Bedford, Mass., will reduce rates by $190,100 per year. The state utilities department has dismissed petitions for lower tariffs on the ground that further reductions might be injurious to the company. Residential customers will reap $82,700 of total cut.

Illinois Power & Light Corporation has announced another rate reduction for Madison and St. Clair counties, effective March 1. This is the seventh rate reduction made by the company in as many years.

Florida Power & Light Company's petition for reopening of the electricity rate case has been denied by Judge William H. Barrett in United States District Court.

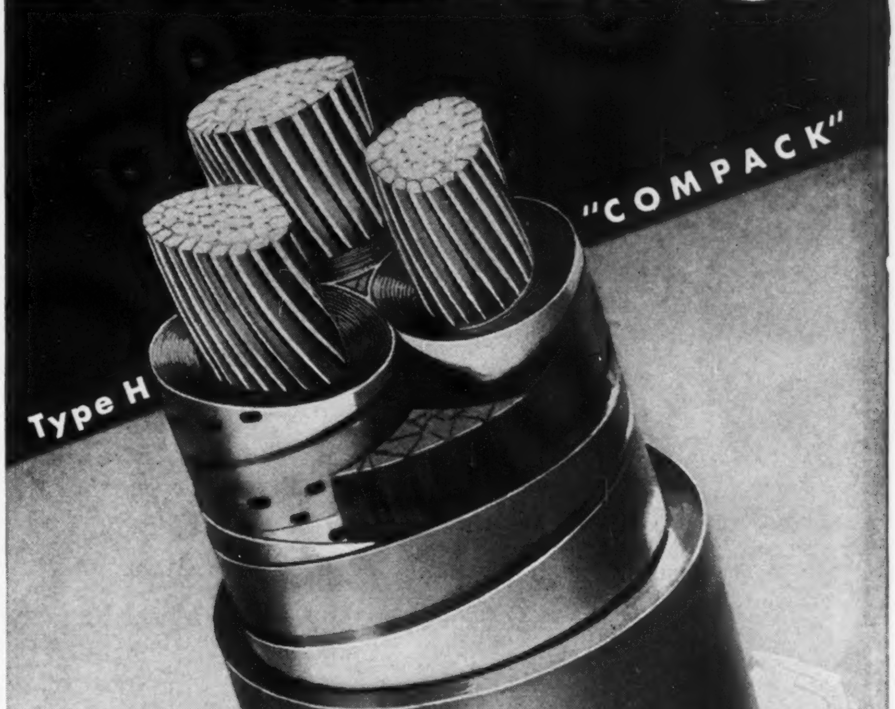
●

Canadian Output Makes Record

Output of electricity in Canada reached a new high level during 1936, when 25,493,474,000 kw.-hr. were produced, a gain of 8.9 per cent over 1935, the Dominion Bureau of Statistics reports. Exports to the United States amounted to 1,578,107,000 kw.-hr., against 1,364,587,000 in 1935.

ROEBLING

Paper Insulated
CABLES



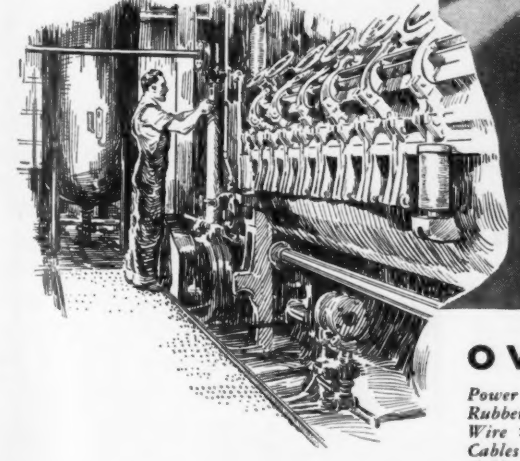
Roebling "Compack" Type H Impregnated-Paper-Insulated Lead Encased Cables with graded insulation are made in single and multiple conductor constructions. Lower voltages cables are unshielded.

All these cables meet the design, manufacturing, test and guarantee requirements of the High Tension Cable Committee of the Association of Edison Illuminating Companies specifications prepared in consultation with the Insulated Power Cable Engineers Association.

We invite your inquiry on this cable or any of the other types listed.

JOHN A. ROEBLING'S SONS CO.
Trenton, N. J. *Branches in Principal Cities*

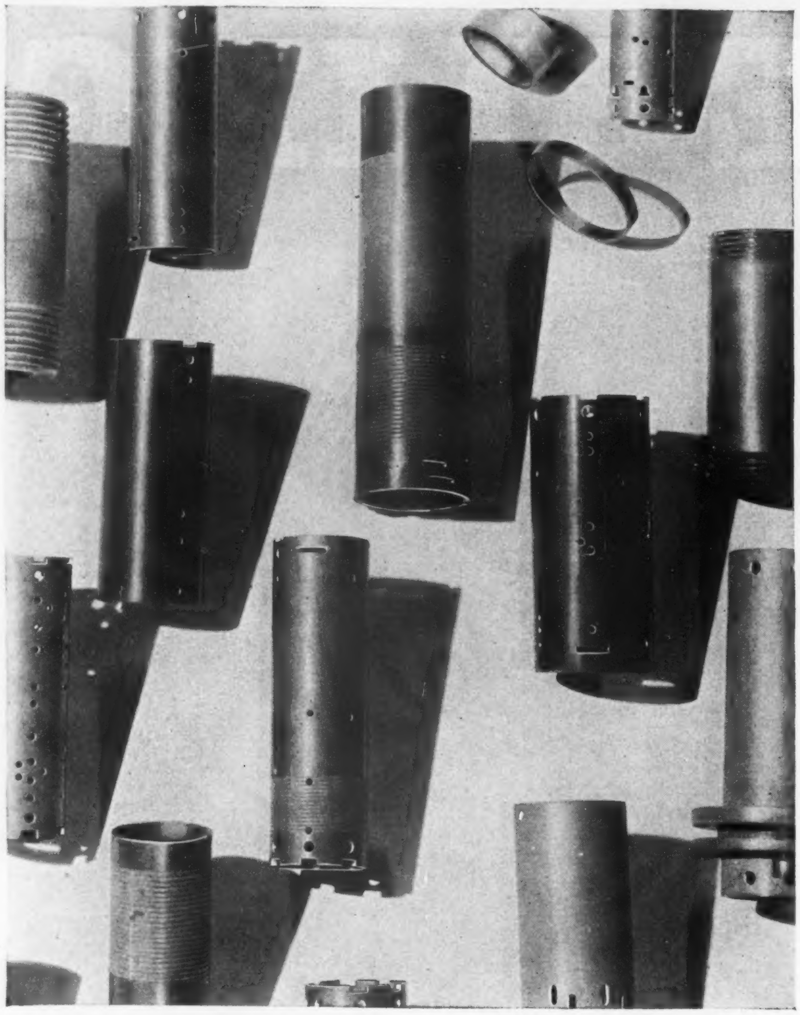
This is the latest design unit for filtering, dehumidifying and degasifying cable oil—one of many operations to assure maximum quality and uniformity of Roebling impregnated-paper-insulated Cables.



OVER 60 OTHER TYPES

Power Cables: Paper; Cambric; Rubber » Parkway Cable » Tree Wire » Service Cables » Station Cables » Rubber Covered Control Cables » Rubber Covered Wires and Cables: Code; Intermediate; 30% and 40% Performance; 35% and 40% Performite; Plain Rubber 60% Sheath Power Cable and 40% or 60% Sheath Flexible Cords » Weatherproof Wires and Cables » And many other wires and cables.

ONLY A FINE PRODUCT MAY BEAR THE NAME ROEBLING



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Made to formula—uniform throughout—permanent in its characteristics—Dilecto Molded Tubing will help solve many of your insulating problems.

It is a homogeneous material, made under heat and pressure, resistant to moisture to a high degree, with excellent insulating qualities and mechanical properties that make it the ideal material for many purposes.

Should you want tubing that can be readily fabricated, which will retain its form and dimensions, and stand up under mechanical strains and thermal shocks—specify Dilecto Molded Tubing.

Properties of all grades of Dilecto Tubing—as well as sheets and rods—are fully detailed in the DILECTO catalog. Ask for a copy.

CONTINENTAL-DIAMOND FIBRE CO.
NEWARK, DELAWARE
Represented in Canada by
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Private Contract Yields to Commission-Fixed Rates

In an opinion written by Justice Butler the U. S. Supreme Court recently held that the Missouri Public Service Commission could alter rates in defiance of private contract between the Midland Realty Company and the Kansas City Power & Light Company without infringing on the constitutional guarantee on impairment of contracts or the "due process" clause.

•

Coosa River Permit Issued

The Federal Power Commission has authorized the issuance of a preliminary permit to William Gray Meharg of Anniston, Ala., for a proposed project consisting of a power house, appurtenant works and equipment to utilize the surplus water or water power from United States Dam No. 2 in Coosa River in Calhoun and St. Clair Counties, Alabama. Installed capacity would be approximately 1,000 hp. Alabama Power Company recently withdrew a protest to the project.

•

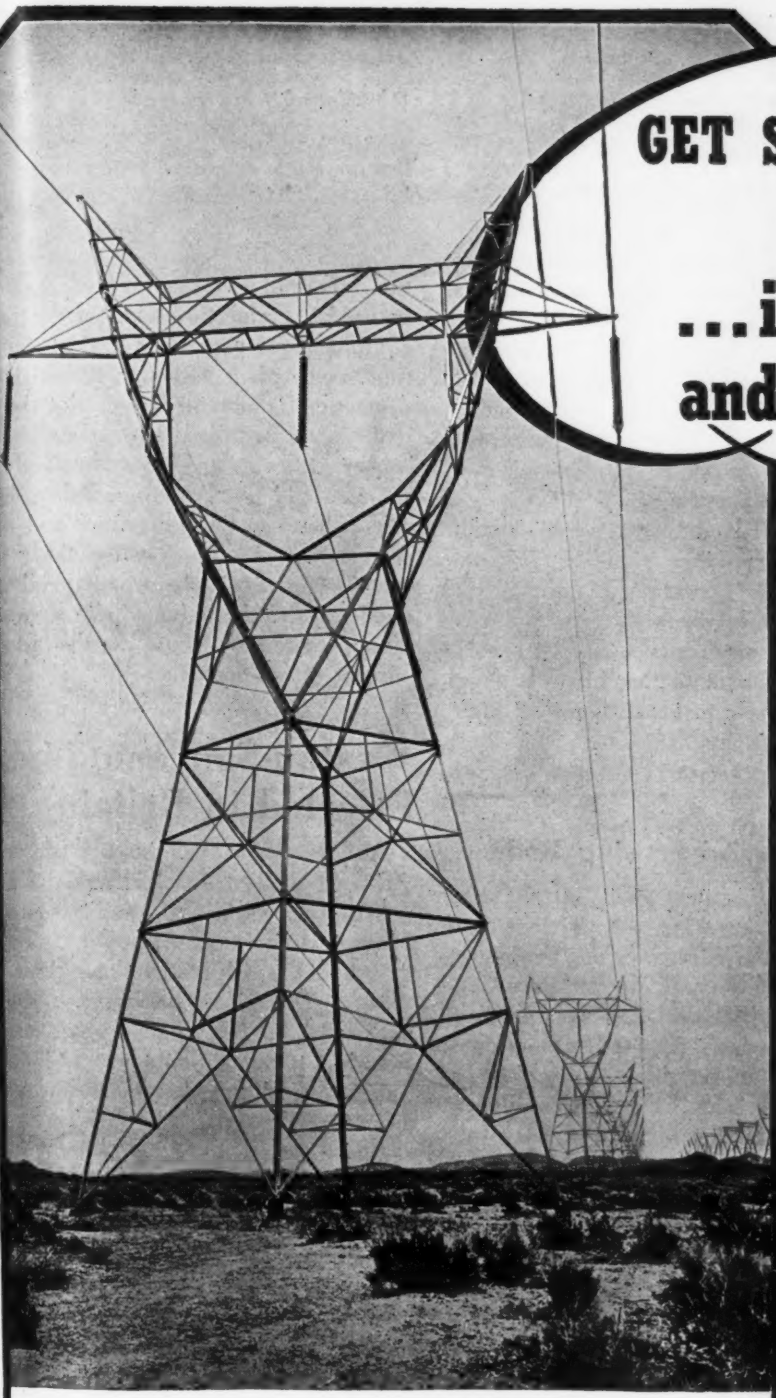
Rate Cuts Total $400,000

In its report covering 1936 the Oregon Public Service Commission announced the following rate reductions for the year: Electric utilities, $266,870; telephone utilities, $110,890; gas utilities, $22,400; total, $400,160. The rate division of the commission entered 1936 with a cash balance of $9,224 and cash receipts totaled $90,146. It completed the year with a total of $16,512 in the fund.

•

Tie-in Unit Installed

During the past year a Metrovic 40,000-kva. transformer was supplied and put into service for tying together the 33-kv. and 11-kv. systems of the Sheffield (England) Corporation at the Blackburn Meadows power station. The site space was rather restricted for such a large natural-cooled unit, but this problem was satisfactorily solved by arranging the radiators in two rows so that any individual radiator could be taken out in case of necessity. The transformer is provided with on-load tap-changing equipment for plus or minus 12½ per cent in twenty steps.



GET SAVINGS UP TO 30%

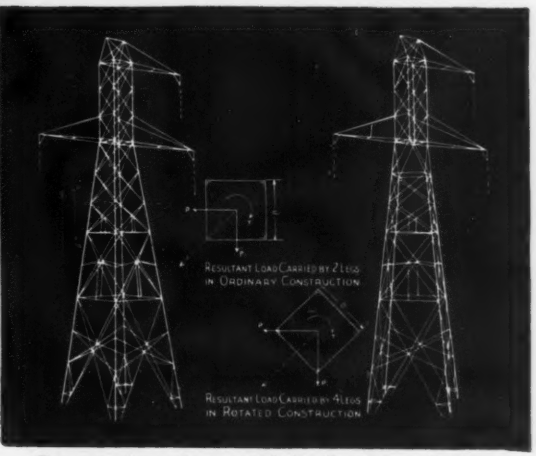
...in excavation and anchor steel

These 287,000 volt rotated towers are used by the Bureau of Power and Light, City of Los Angeles for their Boulder Canyon—Los Angeles lines across the Mojave Desert, a twin line about 250 miles long.

THE most severe loading of a tower due to a broken conductor together with a maximum transverse wind, is usually borne by two legs resulting in a pull at about a 45 degree diagonal.

Distribute this most severe loading evenly to all 4 legs by rotating the lower portion of the tower to this 45 degree angle, leaving the upper part in the regular position, and your savings in the cost of excavations and of anchor steel are considerable—as high as 30%.

This new development is the result of American Bridge experience in designing, fabricating and erecting thousands of towers for all kinds of uses. Call American Bridge Company technicians to assist in the study of your requirements.


Resultant Load Carried by 2 Legs in Ordinary Construction
Resultant Load Carried by 4 Legs in Rotated Construction

Common type tower at left; American Bridge Rotated Type tower at right. On load plans transmission lines run vertically, maximum transverse wind horizontally, thus on common type tower 2 diagonally opposite legs carry resultant load. On American Bridge Rotated Type tower is seen distribution of resultant load to 4 legs, reducing greatly the maximum load on any 1 leg.

AMERICAN BRIDGE COMPANY

General Offices: Frick Building, Pittsburgh, Pennsylvania

Baltimore, Boston, Chicago, Cincinnati, Cleveland, Denver, Detroit, Duluth, Minneapolis, New York, Philadelphia, St. Louis . . . *Pacific Coast Distributors:* Columbia Steel Company, San Francisco . . . *Export Distributors:* United States Steel Products Company, New York.

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Electrical

Manufacturers

Looking for an electrical product? If you are, you can learn who makes it quickly in the Buyers Reference Number of Electrical World. Or if you know only the manufacturer's name or the trade name, the Trade Name and Company Index in this same volume will answer your needs in a jiffy.

In addition, you will find the Product Exhibit Section most helpful in locating branch offices, warehouses, etc.

This handy guide to everything electrical should prove quite helpful in planning your 1937 purchases.

ELECTRICAL WORLD
330 West 42nd St., New York, N.Y.
Headquarters for Everything Electrical

Expulsion Breaker Field Tests

[*Continued from page 38*]

short circuit amounting to only seven cycles.

At this date a total of 80 expulsion type breakers has been put in service, including many which have been modernized with expulsion chambers. In all cases reports on operations have been favorable due to the absence during interruptions of distress or oil throw and also to the radical reduction in maintenance brought about by the small amount of oil carbonization and contact burning.

It is believed that the introduction of the expulsion chamber has improved the operation of present-day oil circuit breakers to such a degree that their performance can be considered equivalent to that of other types of equipment in general use on high-voltage systems.

•

Expands Advertising Budget

With sales in excess of 500,000 units last year, breaking all previous records for the company, the Frigidaire division of General Motors Sales Corporation will launch this year its most extensive advertising and promotional campaign in an effort to achieve a new sales peak, Ellsworth Gilbert, zone manager, told some 2,200 dealers and salesmen at a meeting at the Hotel Astor, New York, last week. The 4,000,000th Frigidaire was recently produced. The meeting was one of 33 being held in various parts of the country.

•

Ohio Welding Conference

Department of Industrial Engineering, Ohio State University, Columbus, Ohio, announces March 3, 4 and 5 as the dates for the sixth annual welding conference and exposition at Columbus. The conference this year will include a special three-day course in arc-welding design and practice. The course will be under the direction of E. W. P. Smith, of Cleveland, Ohio. Information regarding the conference and the special course in arc welding design and practice can be obtained from O. D. Rickly, department of industrial engineering, Ohio State University, Columbus, Ohio.

Synchronism Without Mechanical Connection

[*Continued from page 46*]

accurate and positive method of protection from excessive temperature is by means of thermostats suitably located on the units themselves. In addition to this thermostatic protection, thermal overload relays should be used in connection with the control equipment for protection against short time overloads. Although reasonable protection is obtained with the thermal relay installed with the Linestarter, better protection is obtained if the overload relay is connected in the circuit between the transmitter and receiver, since in this location the current is approximately proportional to the load and the value of the current is approximately equal to the rated current of one motor.

•

Weston-Sangamo Link Effected in Britain

Announcement has been made by the Weston Electrical Instrument Corporation, Newark, N. J., and Sangamo Electric Company, Springfield, Ill., that their English affiliated companies, Weston Electrical Instrument Company, Ltd., of Surbiton, Surrey, and British Sangamo Company, Ltd., of Enfield, Middlesex, became associated through the purchase by British Sangamo of a 51 per cent interest in British Weston, the balance of ownership remaining with the parent Weston Corporation.

Thus two of the oldest and best known names in the electrical measurement industry are linked closely together in England. The English Weston Company will continue as a separate corporation, but will now be headed by S. B. Rogers, chairman and managing director of British Sangamo.

•

High-Speed Sets in England

In order to meet the increasing demand the Yorkshire Electric Power Company, England, is making large extensions to its Ferrybridge power station and has recently placed a contract with the English Electric Company, Ltd., Stafford, for two 40,000-kw. steam turbo-alternator sets to run at 3,000 r.p.m. It is interesting to note that these machines are the first of this output and speed to be ordered for use in Great Britain.

"We match them against any other brand of similar composition—domestic or foreign."

The American Brass Company

Anaconda Ambraloy
(ALUMINUM-BRASS)
Condenser Tubes

Made by Anaconda's
Extruded, Rolled and Drawn Process

We offer Anaconda Ambraloy (aluminum-brass) Condenser Tubes, confident that they are unsurpassed in quality by any tube of similar composition on the market. Accelerated corrosion tests conducted by a disinterested organization disclosed that these tubes lost less weight than did similar tubes of recognized European manufacture.

Ambraloy tubes are one of a comprehensive group produced in different alloys and designed to meet all requirements of marine and stationary condensers. For complete information and data on all Anaconda Condenser Tube alloys and methods of manufacture, write for copy of Anaconda Publication B-2.

37337

ANACONDA
from mine to consumer

This list shows the complete range of alloys offered by The American Brass Company

COMPOSITIONS OF ANACONDA CONDENSER TUBES

Alloy	*Copper %*	*Nickel %*	*Zinc %*	*Aluminum %*	*Tin %*	*Iron %*
SUPER-NICKEL 701	70	30	0	0	0	0
CUPRO NICKEL 712	80	20	0	0	0	0
AMBRAC 850	75	20	5	0	0	0
AMBRALOY 927	76	0	22	2	0	0
AMBRONZE 455	83.5	0	12	0	4.25	0.25
ADMIRALTY ALLOY 442	70	0	29	0	1	0
70-30 BRASS 43	70	0	30	0	0	0
MUNTZ METAL 65	60	0	40	0	0	0
COPPER, DEOXIDIZED 939	99.9	Phosphorus, 0.02%				
COPPER, ARSENICAL 945	99.7	Arsenic, 0.25%				

The above figures are approximate only

Anaconda Condenser Tubes

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Sales Opportunities

ANOKA, MINN.—Has engaged Burlingame, Hitchcock & Estabrook, Sexton Building, Minneapolis, Minn., consulting engineers, to make surveys and estimates of cost for municipal hydroelectric generating plant, with transmission line to city limits and power substation at that point; also for diesel-electric generating station for standby service. Proposed to ask bids in spring.

NEW CASTLE, PA.—Pennsylvania Power Company, New Castle, Pa., plans large equipment and service plant on site of former Rosena furnace of Carnegie-Illinois Steel Corporation at New Castle, recently acquired, to include line shop, substation department, meter department and meter laboratory, general service and repair department, motor division and other departments. Cost reported over $100,000.

DENVER, COLO.—Bureau of Reclamation, Denver, receives bids until March 3 for two 230-kv., 1,200-amp. oil circuit breakers; two 230-kv., 1,200-amp., three-pole, motor-driven disconnecting switch with motor-operated grounding blades; two 230-kv., 1,200-amp., three-pole, motor-operated disconnecting switches, with manually operated grounding blades; one 230-kv., 1,200-amp., three-pole, motor-operated disconnecting switch; one 230-kv., 1,200-amp., three-pole, motor-operated, selector disconnecting switch, with motor-operated grounding blade; one 230-kv., 1,200-amp., three-phase, manually operated disconnecting switch, and one 230-kv., three-phase, outdoor-type lightning arrester, all for installation in Boulder power plant, Boulder Canyon project, Arizona-California-Nevada. Equipment will be installed by government (Specifications 720).

OMAHA, NEB.—Armour & Company Union Stock Yards, Chicago, Ill., meat packer, plans installation of motors and controls, conveyors, loaders, electric hoists and other equipment in new multi-story plant at Thirtieth and Q Streets, South Omaha. Cost about $700,000.

PORTLAND, ORE.—United States Engineer Office, Second District, Pittock Block, receives bids until March 5 for 480-volt, three-phase, metal-inclosed power distribution switchboard, complete with circuit breakers, buses, bus extensions and accessories for Bonneville, Ore., power project (Proposal 263).

FRONT ROYAL, VA.—Viscose Company, 200 Madison Avenue, New York, N. Y., plans installation of motors and controls, transformers and accessories, regulators, conveyors and other equipment in new multi-unit rayon mill on tract of 260 acres of land near Front Royal, recently acquired. A power plant will be built. Entire project will cost close to $2,000,000. Viscose Corporation of Virginia, Inc., Roanoke, Va., a subsidiary interest, will supervise construction and operate new mill.

ELECTRA, TEX.—Has plans under way for new municipal electric power plant and will begin work soon. Fund of $221,000 has been secured through federal aid.

PHILADELPHIA, PA.—Commanding Officer, Ordnance Department, Frankford Arsenal, Philadelphia, receives bids until March 4 for four gasoline engine-driven electric generating units (Circular 450).

ROANOKE, VA.—Appalachian Electric Power Company has approved plans for extensions and improvements in main power substation on Riverland Road, vicinity of Roanoke, including construction of new control building and other structures. New equipment will be installed. Cost close to $200,000.

KINDRED, N. D.—Southern Cass County Electric Co-operative, Inc., Kindred, recently organized, has plans under way for primary and secondary lines for rural electrification in parts of Cass, Barnes and Richland Counties, totaling about 275 miles, with outdoor power substation and service facilities. Power will be secured from municipal generating station at Valley City, N. D. Fund of $290,000 is being secured through federal aid.

NEENAH, WIS.—Kimberly-Clark Corporation plans installation of motors and controls, regulators, conveyors and other equipment in five-story addition to paper mill. Work will begin soon. Cost close to $500,000.

STAYTON, ORE. — Mountain States Power Company, Albany, Ore., plans addition to local power plant, with installation of generator unit and auxiliary equipment. Extensions will be made in transmission lines in this district. Cost close to $85,000.

LAS VEGAS, NEV.—Has plans maturing for new municipal electric power plant and distribution lines. Bond issue of $250,000 has been authorized and work is scheduled to begin at early date. Project has been held in temporary abeyance pending decision of Nevada Supreme Court, which has now determined in favor of municipality.

CORPUS CHRISTI, TEX.—Barnsdall Refining Corporation, Tulsa, Okla., plans installation of motors and controls air compressors, conveyors, electric pumping machinery and other equipment in new oil refinery at Corpus Christi, where site has been secured. Cost close to $500,000.

BARDSTOWN, KY. — Nelson County Electric Co-operative, Inc., Bardstown, recently organized, plans primary and secondary lines for rural electrification in parts of Nelson, Spencer, Washington and Bullitt Counties, totaling about 300 miles, with outdoor power substation units and service facilities. Fund of $315,000 has been secured through federal aid.

BROOKLYN, N. Y.—Signal Corps Procurement District, United States Army, Base, Fifty-eighth Street and First Avenue, receives bids until March 9 for 63,000 ft. of telephone cable, 4,500 ft. of other cable and 20 reels (Circular 126).

PHILADELPHIA, PA.—Resinous Products & Chemical Company, 222 West Washington Street, plans installation of motors and controls, regulators and other equipment in new four-story synthetic resin plant on Richmond Street, for which superstructure will begin at early date. Cost close to $100,000.

ST. PAUL, NEB.—Howard County Rural Public Power District, St. Paul, has plans maturing for transmission and distributing lines for rural electrification in parts of Howard and neighboring counties, totaling over 350 miles, with power substation and service facilities. Fund of $400,000 has been secured through federal aid. Henningson Engineering Company, Union State Bank Building, Omaha, Neb., is consulting engineer.

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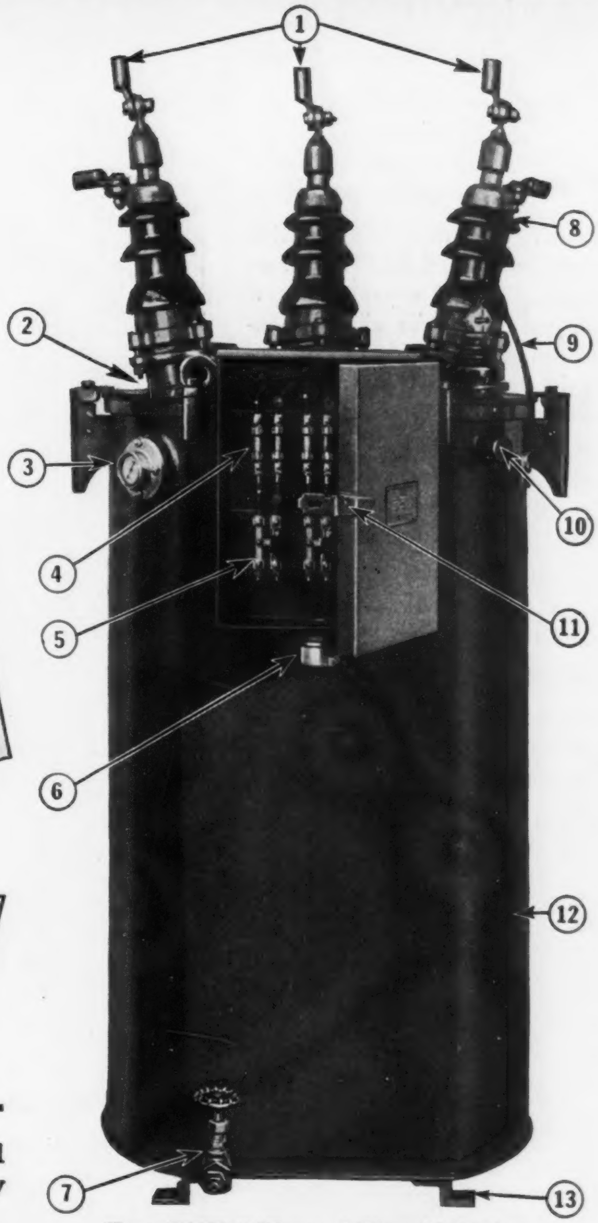

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BOOK REVIEWS

Mechanics, Molecular Physics, Heat and Sound

By R. A. Millikan, Duane Roller and E. C. Wilson. Published by Ginn & Company, Boston, 1937. 498 pages. Price, $4.

A textbook of college grade, combining theoretical and laboratory work in the physical aspects of mechanical engineering with an unusual intermediate content of historical background, finely illustrated and including a comprehesive bibliography and index of both names and subjects. The relationship of scientific research and engineering practice are admirably exemplified in the topical presentations and the book is "humanized" by many halftones of famous investigators, noted laboratories, pioneer apparatus and facsimilies associated with savants from Galileo to Lord Kelvin. It contains highly valuable review material for the electrical engineer desiring to freshen his knowledge of mechanics and physics from the laws of motion and dynamics through heat and sound.

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Electrical Characteristics of Power and Telephone Transmission Lines

By Ferris W. Norris and Lloyd A. Bingham. International Textbook Company, Scranton, Pa. 272 pages, illustrated. Price, $2.50.

This is an introductory study of transmission circuits, but is in no sense elementary because it gets quickly into hyperbolics in setting up the characteristic equations for long lines with distributed properties. Space and emphasis are about equally divided between power and telephone circuits and for each the treatment gives all the steps in the evolution of the governing equations. Networks, phase shifts, attenuation, distortionless transmission, loading, inductive interference and traveling waves are subjects of closing chapters. One appendix section lists design and derived characteristics for eight typical high-voltage power lines. Four place tables of hyperbolic, exponential and trigonometric functions are also included (up to 6 radians).

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Forty Years of Sangamo

By Robert C. Lanphier. 108 pages. Privately printed.

"Sangamo happened this way," so the book begins with the meeting in 1896 between Jacob Bunn, Jr., and Ludwig Gutman, who had some novel ideas for an induction watt-hour meter. The author, then a freshly minted E.E. from Yale, came upon the scene the next year when Mr. Bunn, stating his own lack of electrical knowledge, asked the young engineer to look over and report on the experimental and developmental work on the Gutman theories that had been started in a corner of the Illinois Watch Company factory. Through the early years of the meter art the account moves on, hard work in development and design, that was rewarded impartially with heartbreaking failure and the thrill of success, the barehanded competition in a growing business field, suits and counter-suits in patent litigation, until, in 1903, Sangamo put the induction meter aside and started the developmental grief all over again with the mercury meter idea. With the expiration of the Tesla patents in 1910, Sangamo again took up the induction meter and shortly after offered its type H to the trade. As a history of the growth of a typical successful American business, the book is a valuable record, but its chief interest, particularly to less youthful contemporaries, is in its very personal references to the men, many of them active and well known in the electrical industry today, who participated in greater or less degree in the building up of Sangamo.

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Staat und Energiewirtschaft

By A. Friedrich. Published by Frank'sche Verlagshandlung, Berlin. 156 pages.

This book deals with the relationship between the national government and the electrical power industry under the present régime in Germany. The energy group, of which the power industry is a constituent, is one of the groups into which the country's economic resources are classified, and, like the others, it is under direct governmental control irrespective of type of ownership. The law creating this group and providing for its administration is quoted at length, as are various decrees, regulations and addresses by authoritative spokesmen. As a background, the author reviews the status of the power industry in relation to the government during the various earlier periods from the pre-war era through the subsequent economic upheavals.

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The Capitalistic System and The Nature of Unemployment

By Alfred Alsaker. Published by the Pioneer Publishing Company, Oak Park, Ill. 255 pages. Price, $3.50.

Unemployment is the balance wheel of the capitalistic system. Intelligent regulation of that balance wheel to prevent its extreme swings in boom and depression times is the way to keep the capitalistic machine running evenly and thus to realize the maximum benefit of its capacity for accomplishment of human progress and happiness. These are the conclusions of the late Alfred Alsaker, electrical engineer and thinker on the problems of our modern society, in this posthumously published book.

The descending spiral of business activity caused by the inability of unemployed people to consume goods produced is demonstrated in mathematical terms to be curable only by maintenance of the unemployed's capacity to buy and use. This is a generally recognized principle today. But Alsaker's book proves in the same irrefutable arithmetic that contemporary efforts to provide buying power for the unemployed by forced extension of public works and by other unproductive make-work projects are entirely wrong, as is also the idea of spreading employment by reducing hours of labor per man. Instead, the unemployed should be held up to a comparatively high level of purchasing power by outright giving of money to spend. The maintenance of consuming demand thus achieved will keep up and expand production, which will then enlarge employment. The cash for the unemployed would come from the profits of production that usually transform themselves into the great amount of idle money that is characteristic of depression times. In simple terms, industry comprises two functions, production and consumption, and capital investment in consumption is just as necessary as it is in production.